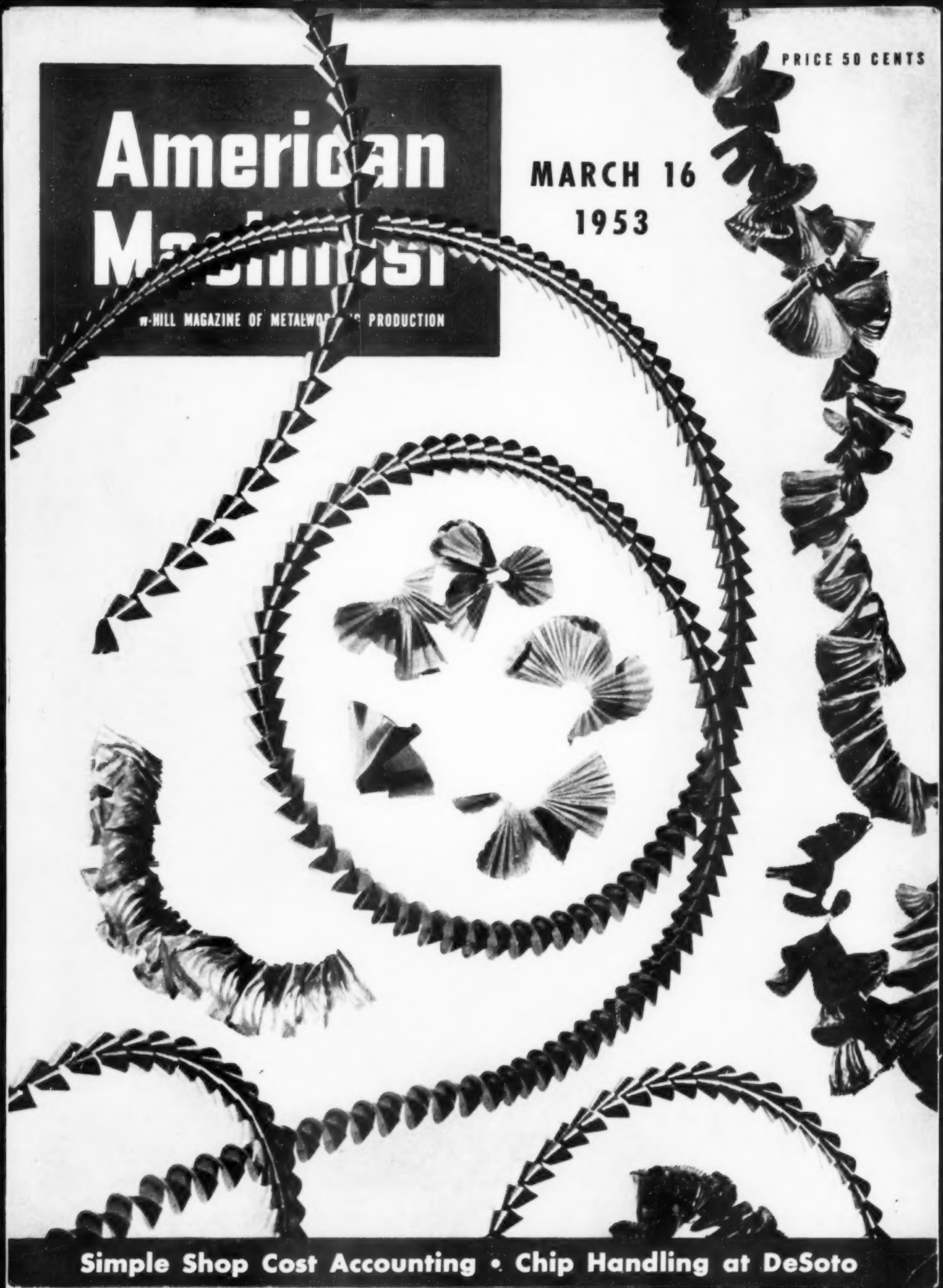
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American
MARCH 16
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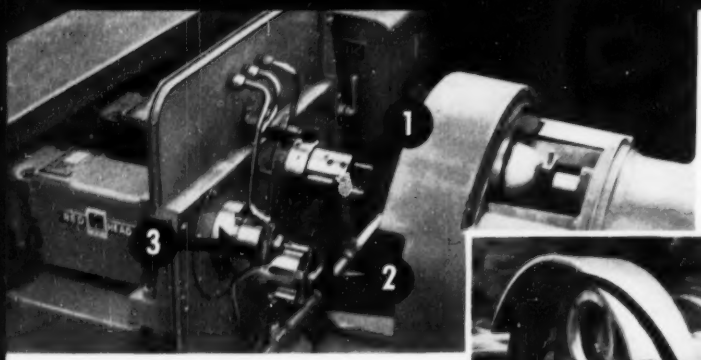
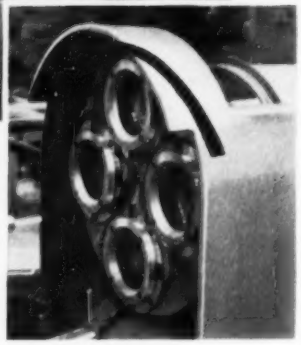
Simple Shop Cost Accounting • Chip Handling at DeSoto



The three multiple-tool boringhead stations shown above perform a variety of precision finishing operations on eight different surfaces of fan motor end frames. Small cylinder at top station is an unloading ejector.

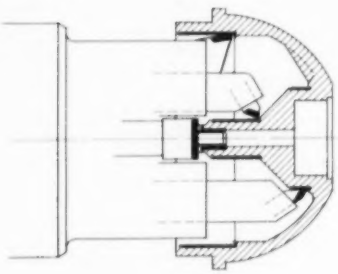
The workholding fixture shown at the right is rotated in 90° increments, presenting parts to each of the three boringhead stations in proper sequence, as indicated below.



ROTARY INDEXING

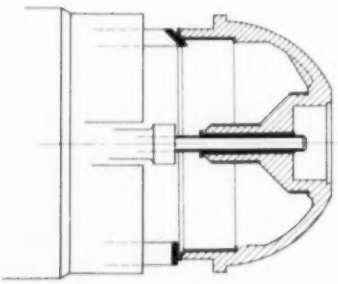
puts fan-motor housings on a high production basis

Heald Model 221 Bore-Matic bores, reams, turns, faces and chamfers motor end frames in continuous, consecutive cycle



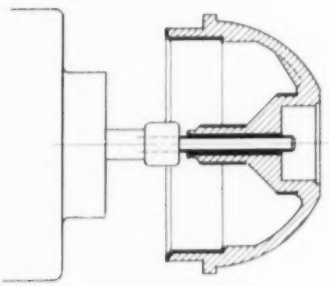
STATION 1.

Bore, turn two diameters, face shaft end and start reaming of center hole.



STATION 2.

Face and chamfer end of frame — rough ream full length of center hole.



STATION 3.

Finish ream center hole.

● Here's another example of how Heald engineering found the answer to a high-precision multiple borizing problem.

By means of the four-station rotary indexing fixture shown above, parts are presented in sequence to each of three boringhead work stations. The fourth station, at the top of the fixture, is used for loading and unloading.

For the long, small diameter center hole on this particular job, a reamer is used in preference to a boring tool in order to avoid chatter problems and assure a smooth, clean bore. The operations performed at each station are shown at the left. The entire machine cycle is fully automatic and parts are loaded and unloaded at the top station while the other three stations are borizing. A completely finished part is brought to the unloading station at each 90° rotation of the indexing fixture.

Remember — when it comes to precision finishing, it pays to come to Heald.

HEALD

Case Study No. 2240-96 in **PRECISION PRODUCTION**

INTERNAL AND ROTARY SURFACE GRINDING MACHINES AND BORE-MATICS

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Chips & quips

Chips . . . Last October, we had the pleasure of watching a Hardinge lathe put through some very tough paces up at the Elmira plant. When it was over, we gathered up some of the "prettier" steel chips to explain to our waiting wife what had kept us so long. When they proved too brittle for her to use as Christmas-tree ornaments, we suddenly realized that they might make an unusual and attractive cover. So here they are, as photographed by Hans Basken of the McGraw-Hill Studios. They sort of tie in with the article on chip handling in this issue—although that comes from DeSoto's V-8 engine plant. Just for statistics, 136 tons of CI chips, over 30 tons of steel, about 3 tons of aluminum, and 6 tons of grinding chips must be handled there each week. This story, by Associate Editor Brosheer, is loaded with pictures and drawings that show details of drag-chain conveyors, an interesting chip-removal tank, a conveyor that delivers chips in two directions (fine at one end, heavy at the other), and baffles and settling.

Small-Plant Costs . . . Albert E Grover, cost consultant of Cleveland, provides our current Special Report, 16 fact-filled pages on simple cost accounting for the shop. It's down to earth and practical, thus very useful. Mr Grover has had much experience in metalworking plants, and this is a distilling of his experience that anyone can use.

Quarter Million . . . William Wilson, works manager at the Walker-Turner Division of Kearney & Trecker, provides us—and you—with an unusual 6-page fold-out insert on saving production money to the tune of a quarter-million dollars a year. The answers lie in consolidating from two buildings to one, in re-layout, in better handling, and in improved methods. Productive capacity is up 20%, floor space down 40%, inventory halved—and in a job-lot plant employing about 400 men. The story also includes four examples of production increases from 2 to 400%.

Self-Positioning Jig . . . Robert Double of Westinghouse has a simple solution to cut carbide-drill breakage in drilling Micarta. It involves a self-positioning jig, and could well serve on other jobs. There's also a single pager on dicing machines, as used at Ford, that will interest tool engineers too.

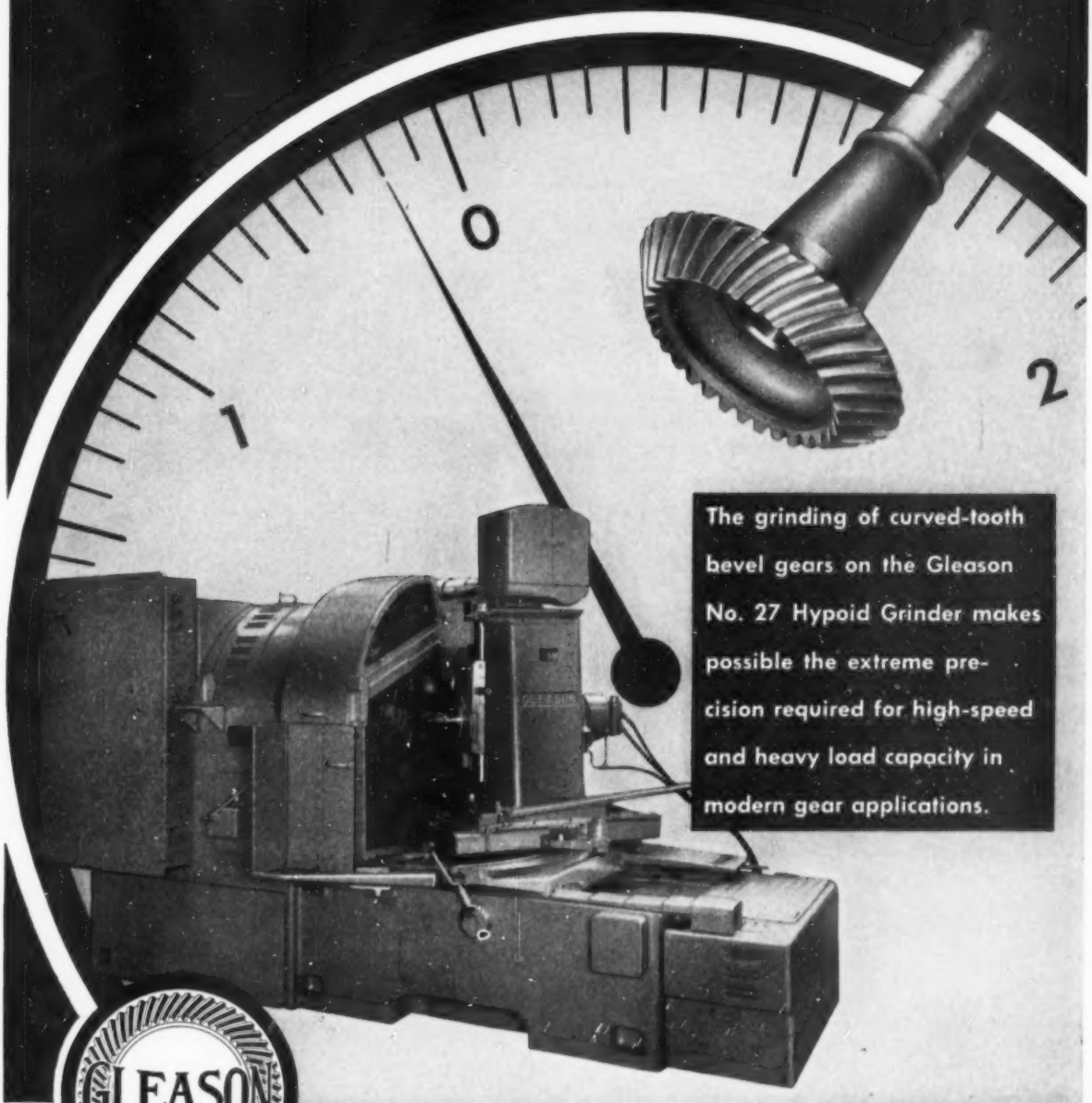
Supervisors . . . Carboloy has borrowed an idea from conventional apprentice-training programs to prepare men for supervisory responsibilities. This issue gives a quick run-down of the 3-phase program which provides both broad general training and specialized on-the-job training. You can tailor the idea to your own needs.

Graphic Estimater . . . Philip Anjanos of Beloit, Wis, has worked out an extremely interesting way of estimating time for machining operations. He uses a transparent sheet over the shop drawing, and the work outline pinpoints a time printed on the sheet. Times are the same as standard data values, but direct reading from the print cuts the computation. The author realizes a time saving of 66% with it. Modification would make it suitable for rate-setting.

Induction Threat . . . As of June 1, you'd better have your induction heaters shielded—or they'll be shut down until you do it. The Federal government is clamping down, to stop interference with radio, TV, and radar. So we asked Allis-Chalmers to tell us—and you—how to handle the problem. Details are in a 3-page article in this issue. Better read 'em now—and save trouble later.

Coming . . . Mar 30 *AM* will include a Special Report on understanding carbon steel, plus articles on strippers and ejectors, on coordinate setting, on brazing titanium, and the concluding article in Direk Olton's series on abrasive-belt machining.

GRINDING ACCURACY



The grinding of curved-tooth bevel gears on the Gleason No. 27 Hypoid Grinder makes possible the extreme precision required for high-speed and heavy load capacity in modern gear applications.

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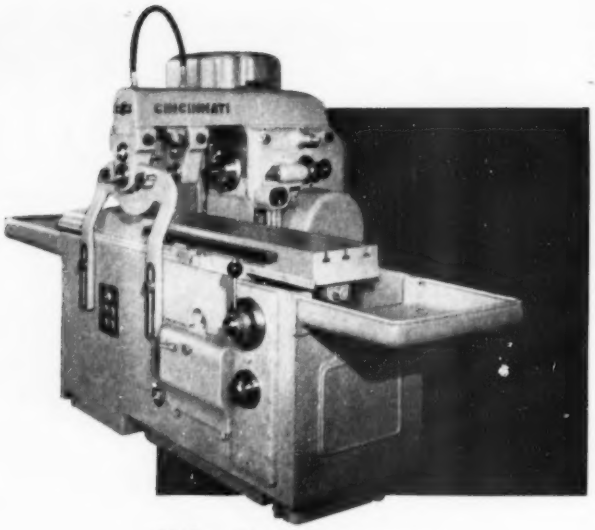
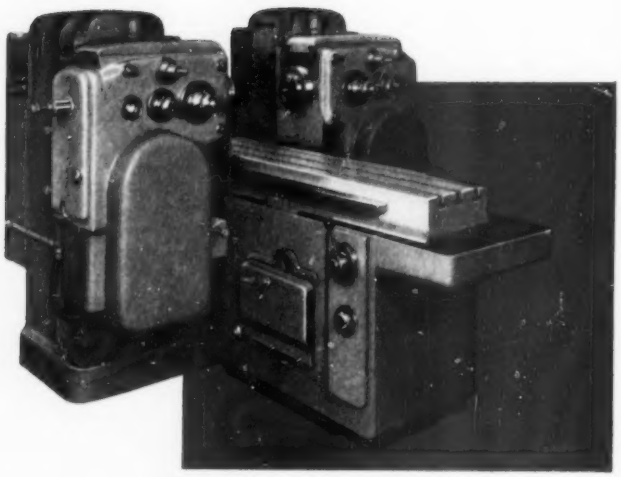


Plain style, new CINCINNATI No. 2-24 Automatic Milling Machine

new



Duplex style, new CINCINNATI No. 2-24 Automatic Milling Machine

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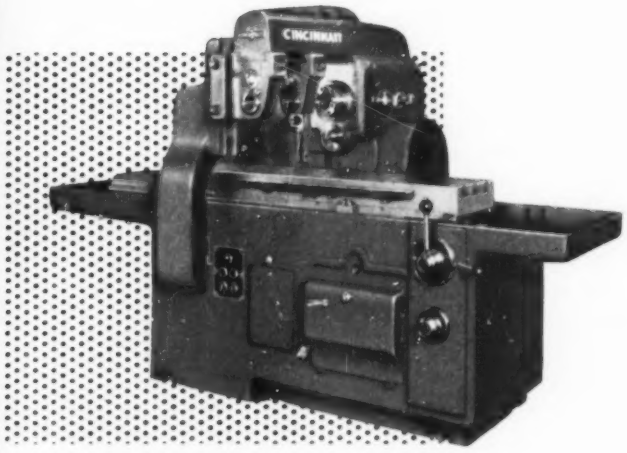

Plain Rise and Fall style, new CINCINNATI No. 2-24 Automatic Milling Machine

You can always look to Cincinnati Milling for the finest in machine tools. Cincinnati's newest is the No. 2-24 Automatic, an outstanding example of fine engineering and workmanship, combining advanced production features and easier, more convenient means of setting up the job. ¶ There are three styles: Plain, Duplex, and Plain Rise and Fall. All have two-way table feed cycles with cycle selector control; automatic backlash eliminator; automatic spindle stop; Dynapoise overarm. You may obtain complete information by writing for 28-page catalog No. M-1760. Brief data in Sweet's Catalog File for Mechanical Industries.

new

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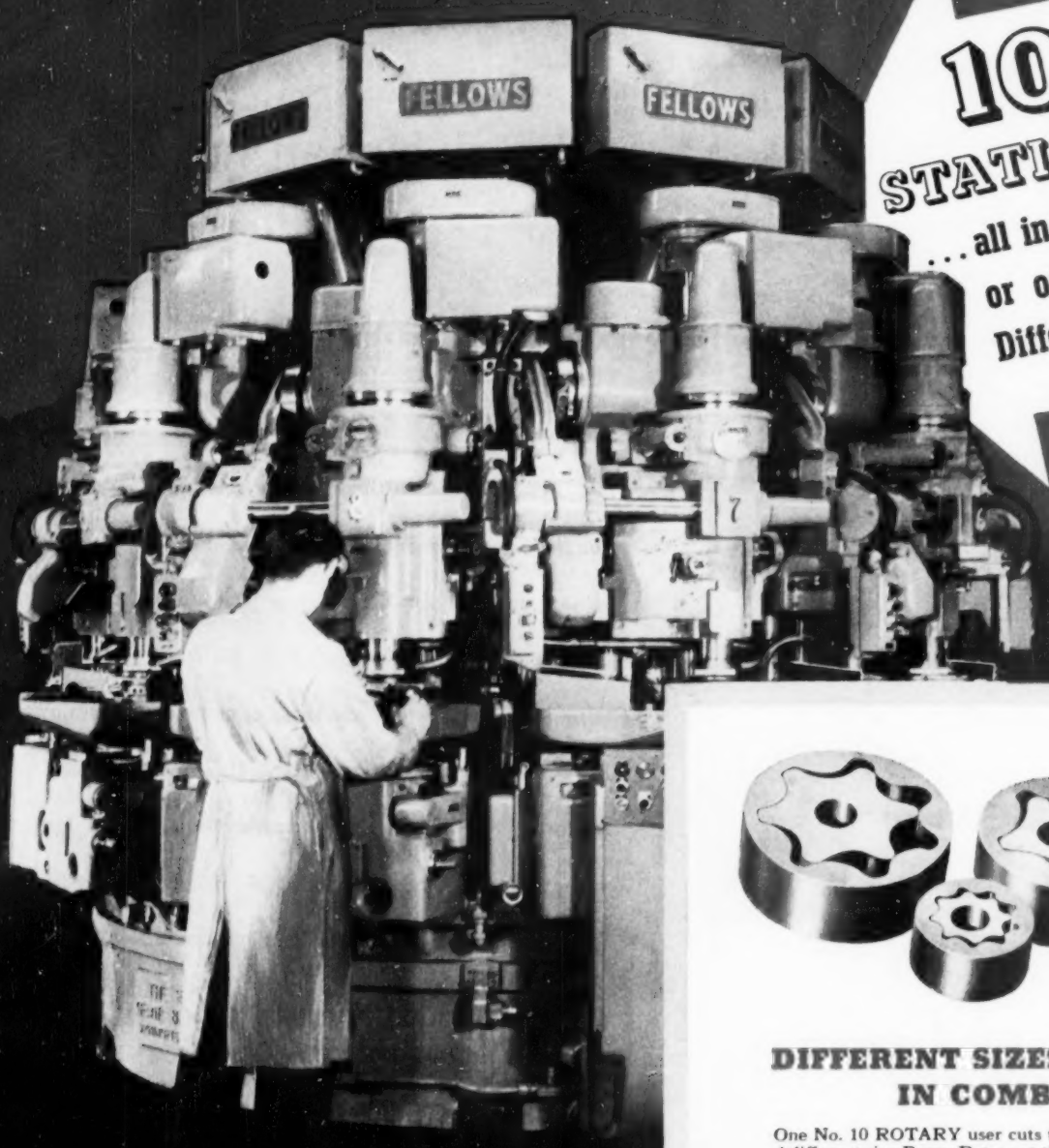


10 STATIONS

... all in One Part, or on 2 to 10 Different Parts

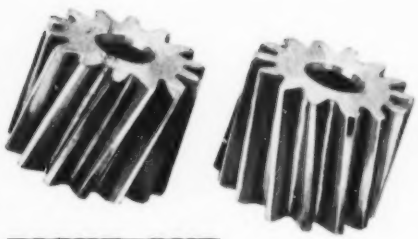
DIFFERENT SIZES IN COMBINATION

One No. 10 ROTARY user cuts the inner profile of *4* different size Pump Rotors at the same time. Production is proportioned–3 stations each for the 1.5" and 2.25" O.D. sizes and 2 each for the 1.75" and 2.75" O.D. parts. Feeds are different for each of the four parts. Strokes per minute of cutter set at 330 for one part and 287 for the other three. Production is . . .

ONE EVERY *10* SECONDS

"PRODUCTION with MAXIMUM FLEXIBILITY"

THE FELLOWS NO. 10 ROTARY carries gear-cutting machine design far ahead in this exact direction. A GEAR SHAPER engineered for heavy duty stock removal at highest speed, it is at the same time a precision tool for work of high accuracy and fine finish... *AND*, each of the 10 gear-cutting stations is a completely self-contained production unit, on which the feed, speed and length of cutter stroke can be adjusted independently. You can cut 10 identical parts at all 10 stations, or any desired combination of different parts—as required... Our engineers will be glad to confer with you on general gear production or specific problems.



RIGHT- AND LEFT-HAND PINIONS IN 50/50 QUANTITY

One automobile transmission plant has demonstrated that the No. 10 ROTARY can set records for quality and speed in turning out 1.375" P.D. helical Pinions. *AND* one big FELLOWS machine can handle requirements for BOTH right- and left-hand parts. Material is SAE 1113. Pinions are 14 teeth, 10 pitch, 20° p.a., 13° 7′ helix angle and 1¼" face width. For fine finish, two cuts are taken while the turret makes on revolution. Parts come off the machine at the rate of...

ONE EVERY 21.4 SECONDS

ALL 10 STATIONS SET UP FOR ONE GEAR PART

Another big automobile plant cuts the internal spur teeth on cast iron drum gears of this design. Here total machine production concentrates on the one part. Design calls for 54 teeth, 10/20 pitch, 30° pressure angle, and 1-3/16" face. One single cut produces good gears at...

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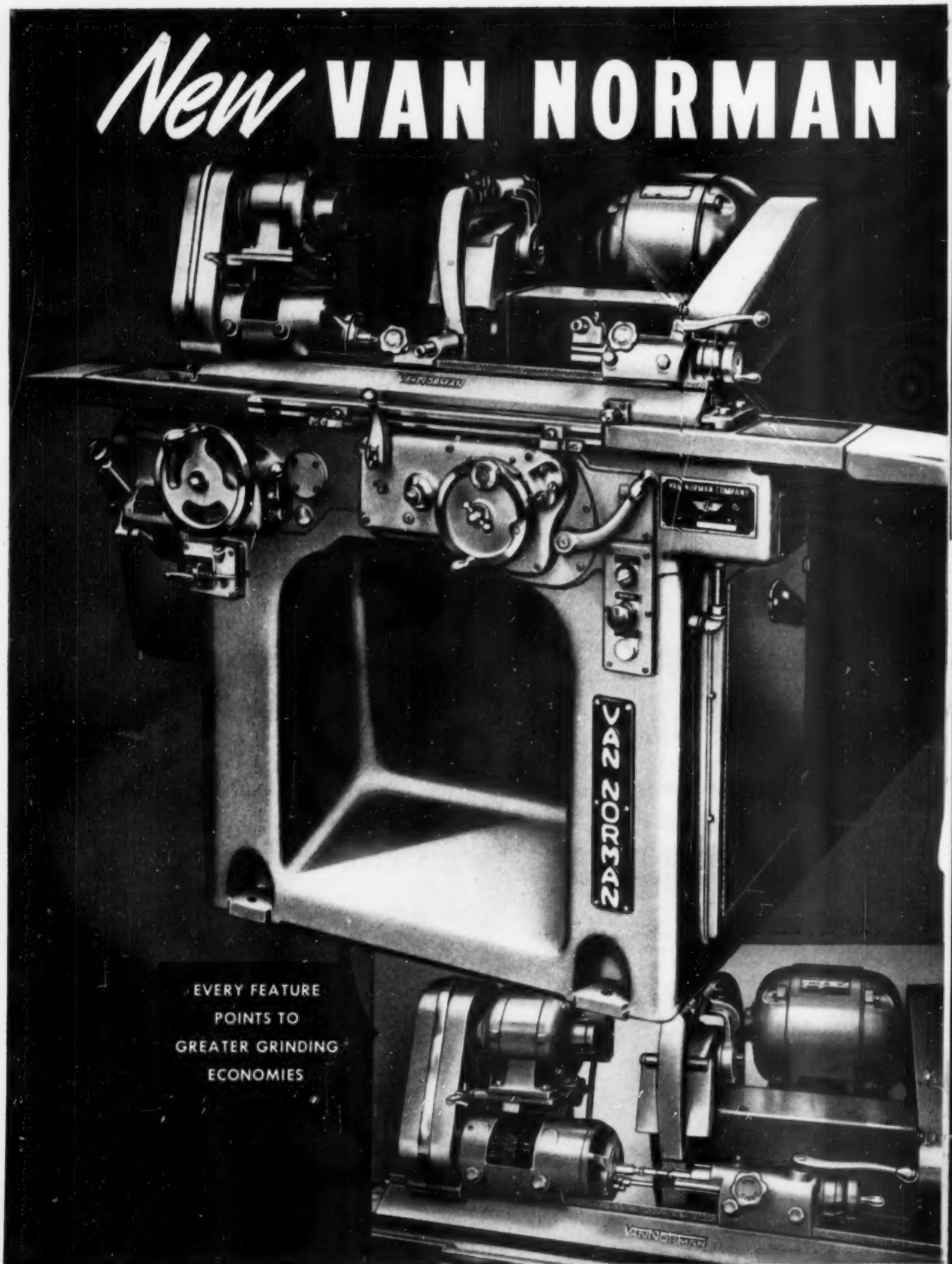
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EVERY FEATURE
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GREATER GRINDING
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418 Cylindrical Grinder

Engineered to Save Time...Reduce Costs

Of Short-Run or Production Grinding of Small Parts!

Here's the *new* Van Norman Cylindrical Grinder that is making history in fast precision traverse or plunge grinding of small parts. Quick to set-up, easy to operate, this grinder cuts grinding costs in toolrooms, job shops or machine shops.

The 418 Grinder is especially designed for ease of operation. Recessed base design permits operator to sit or stand comfortably at the machine. Heavy-duty quality construction throughout assures smooth accurate finish.

COMPARE THESE ADDITIONAL ADVANTAGES

- *Pope wheel spindle equipped with heavy-duty SKF double row cylindrical roller bearings.*
- *Single lever control for rapid traverse and plunge grinding*
- *Rugged base, wide table bearing ways, separate motor drives for wheel spindle, table and headstock*
- *Minimum floor space needed, only 43½" x 79¼"*

Find out how you can increase production output of grinding small parts. Ask about the price, too... *it's exceptionally low* for such a high quality machine. Write:

VAN NORMAN COMPANY
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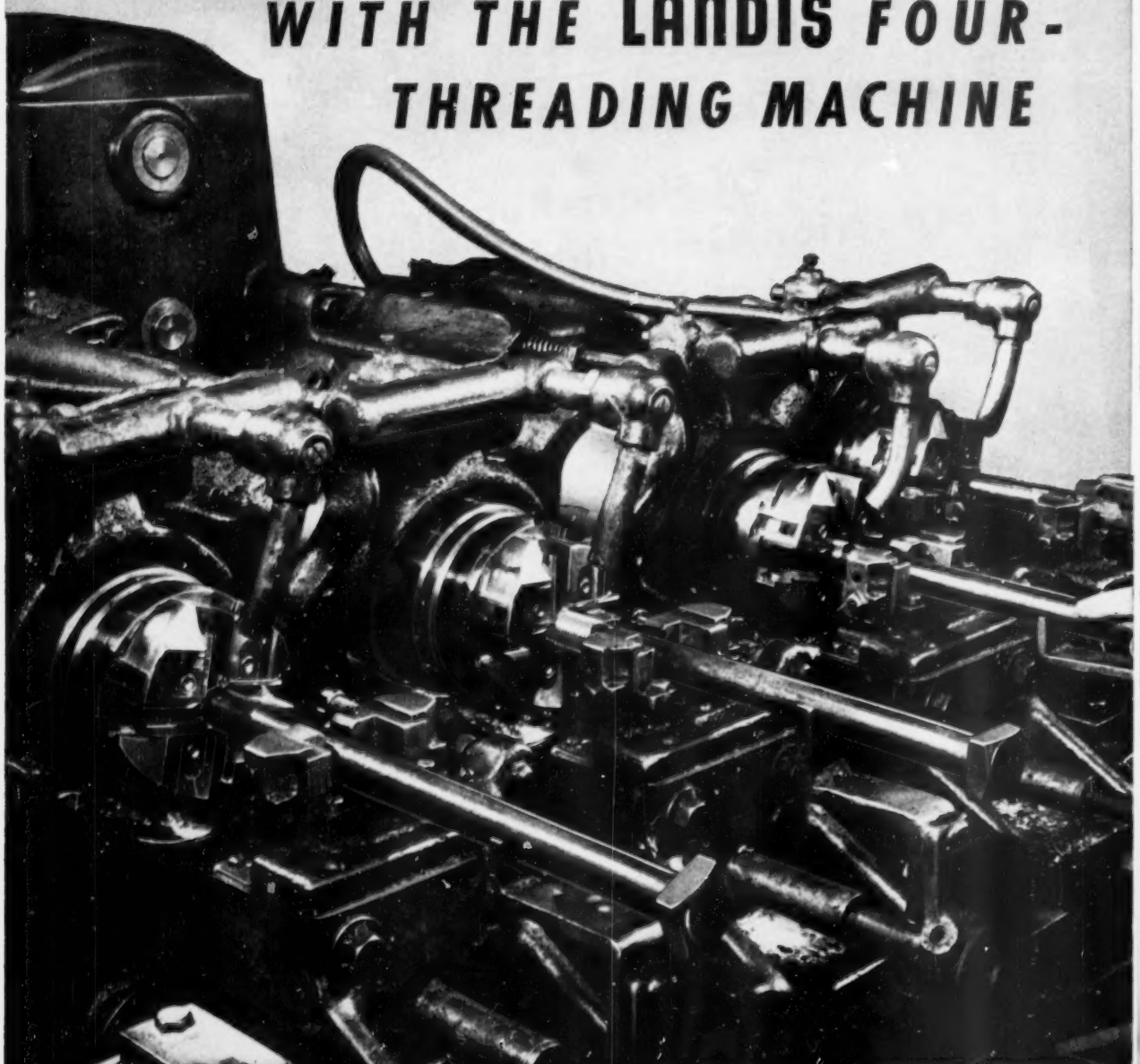
WITH THE LANDIS FOUR-THREADING MACHINE



LANDIS Machine COMPANY

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Every 4⅓ Seconds ! ! ! !

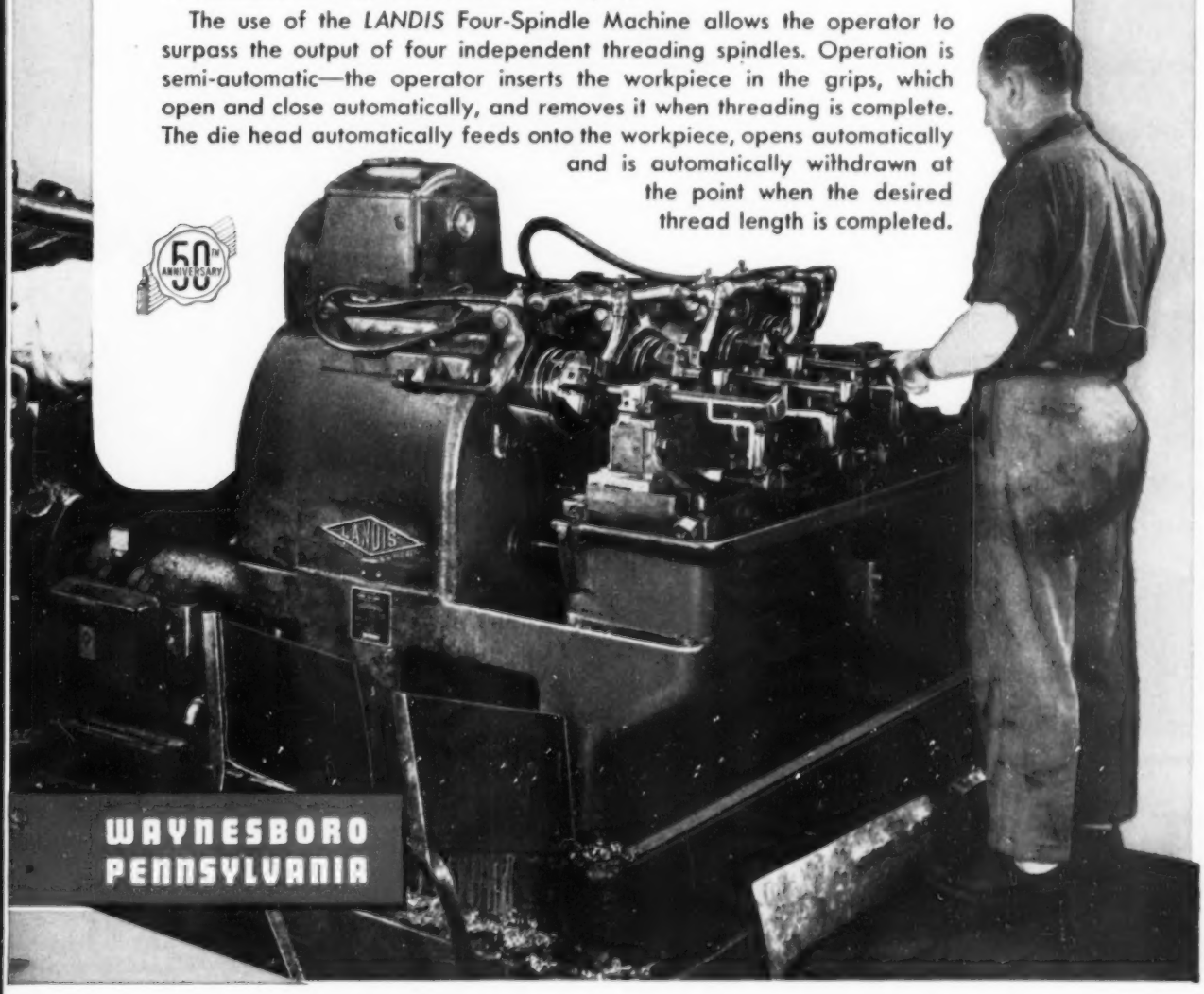
SPINDLE SEMI-AUTOMATIC

A single operator at the Pittsburgh Screw and Bolt Corporation produces an average output of 840 machine bolts per hour.

This operation requires the threading of 1″ Square Head Machine Bolts from Commercial Steel blanks of 217/163 Brinnel hardness. 1″ 8 pitch USS threads are cut 2¾″ long at a cutting speed of 44 surface feet per minute. Production is continuous and chaser cost is extremely low.

The use of the *LANDIS* Four-Spindle Machine allows the operator to surpass the output of four independent threading spindles. Operation is semi-automatic—the operator inserts the workpiece in the grips, which open and close automatically, and removes it when threading is complete. The die head automatically feeds onto the workpiece, opens automatically and is automatically withdrawn at the point when the desired thread length is completed.

50th ANNIVERSARY



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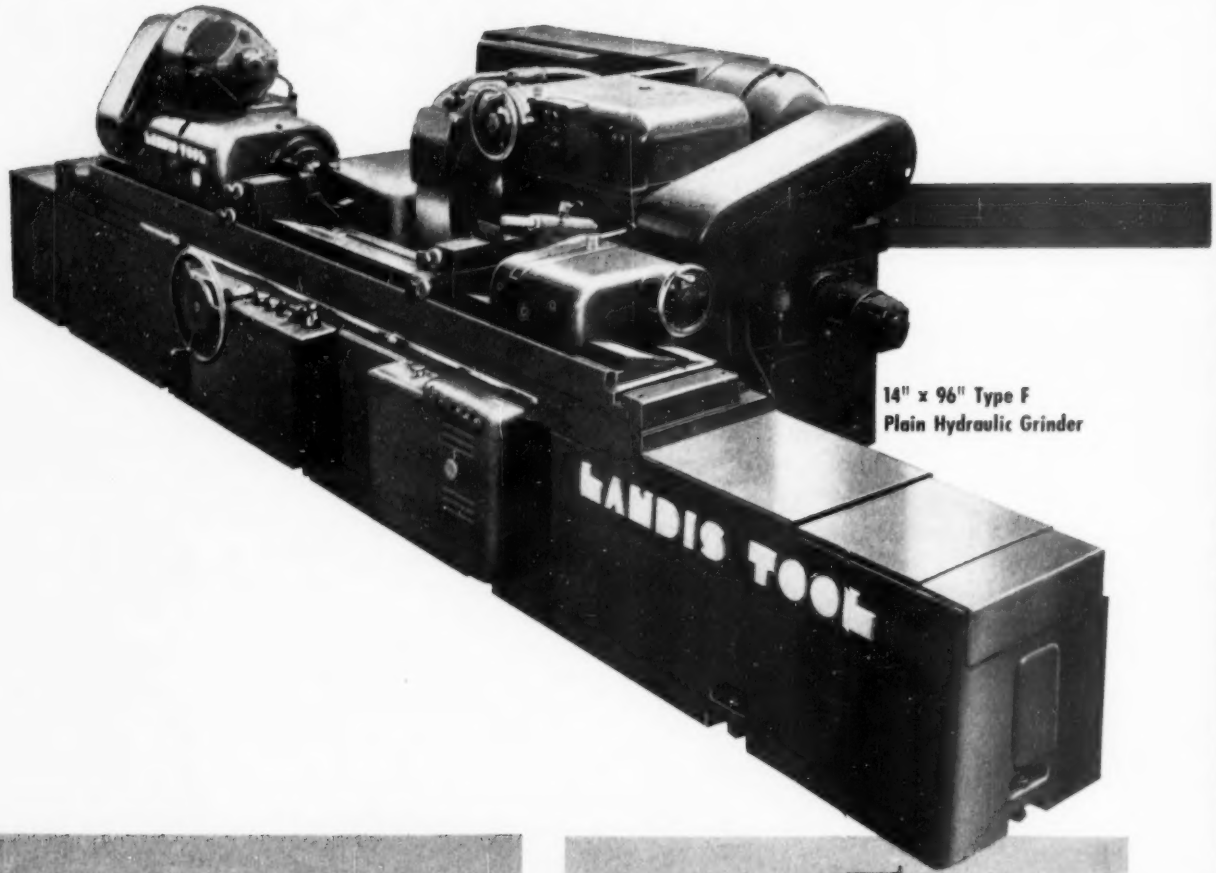
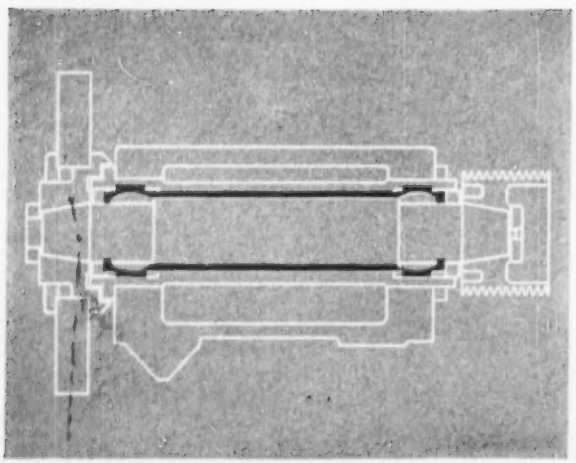
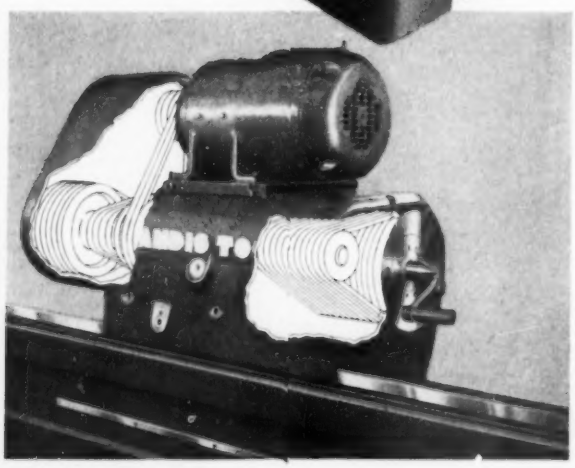
PERFORMANCE — The Only True Test



14" x 96" Type F
Plain Hydraulic Grinder



Pressure Lubricated Microsphere Spindle Bearings



Vee Belt Headstock Drive

LANDIS

precision grinders

# of a Modern Precision Grinder

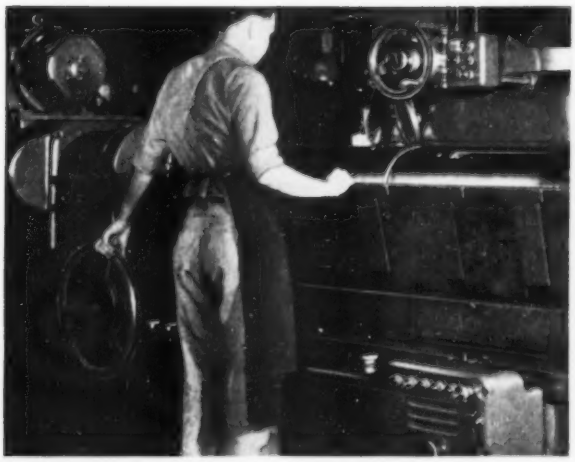
Performance is measured this way

- INCREASED PRODUCTION resulting in lower unit costs.
- UNIFORMITY OF WORK PIECES in size and finish.
- MINIMUM DOWNTIME for regular maintenance.

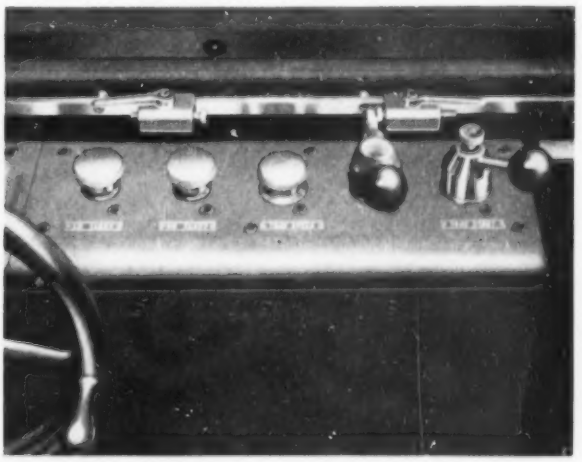
Performance features of Landis Type F plain grinders

- ADJUSTABLE HYDRAULIC AND ELECTRICAL CONTROLS for selection of correct feeds and speeds.
- CONTROLS EASILY ACCESSIBLE TO OPERATOR reduce operator fatigue.
- MICROSPHERE WHEEL SPINDLE BEARINGS have close clearance for fine finishes and quick sparkout.
- WHEEL SPINDLE has extra large diameter between bearings for maximum rigidity to withstand heavy cuts.
- VEE BELT DRIVES for work and wheel drives give smooth power transmission for fine finishes.
- PRESSURE LUBRICATED WAYS AND SPINDLE BEARINGS insure safe lubrication at all times.

For complete details write for Catalog F-48. Production estimates and tooling suggestions will be made on the basis of your blueprints.

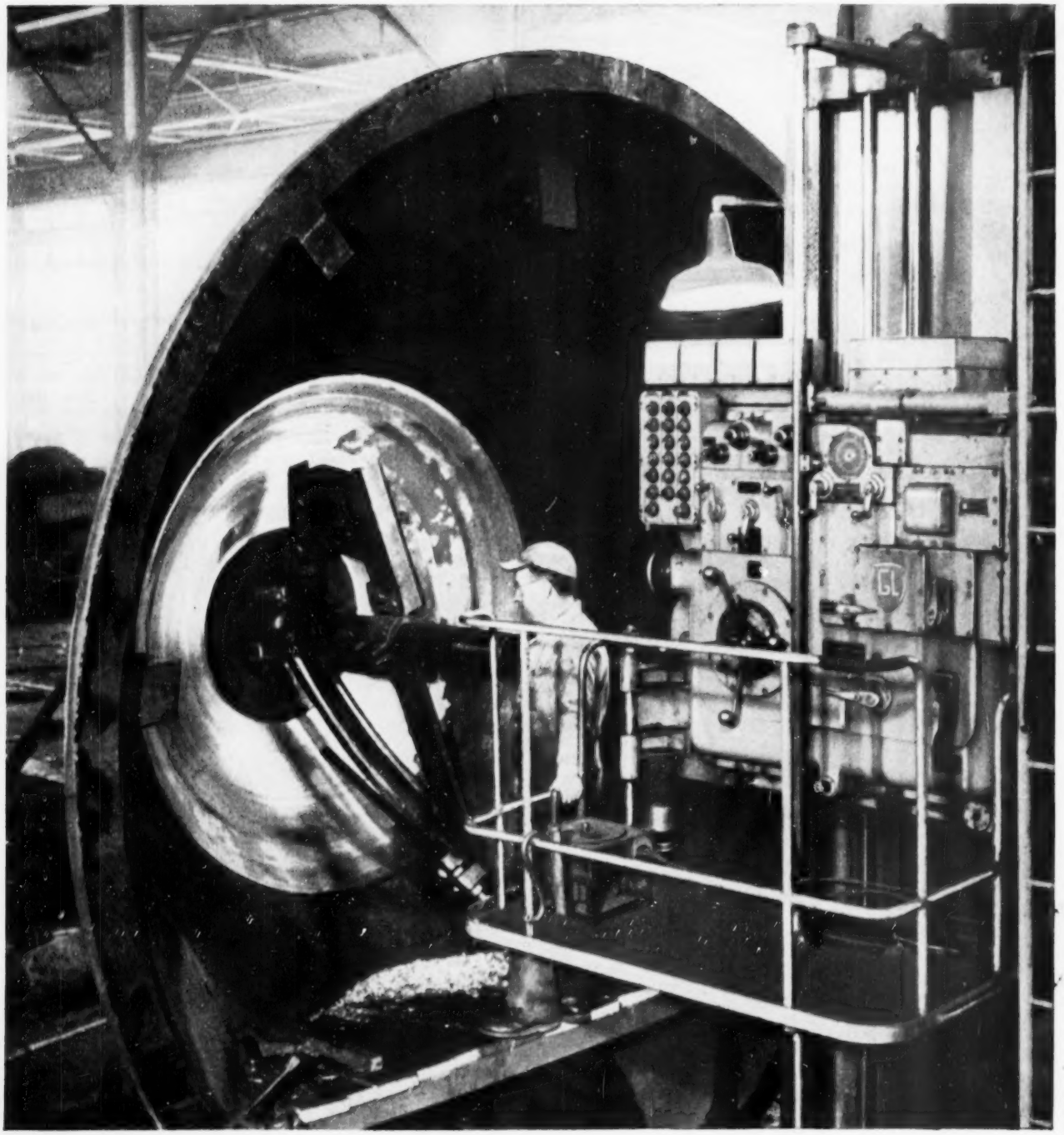


Grouped Operating Controls

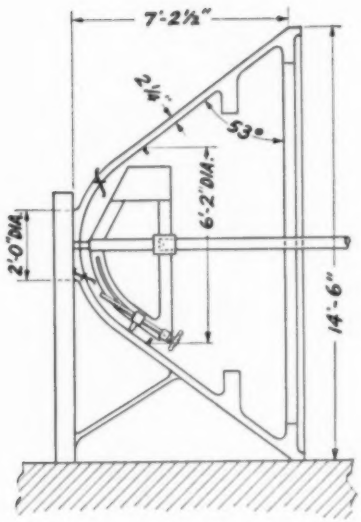


Adjustable Hydraulic Controls

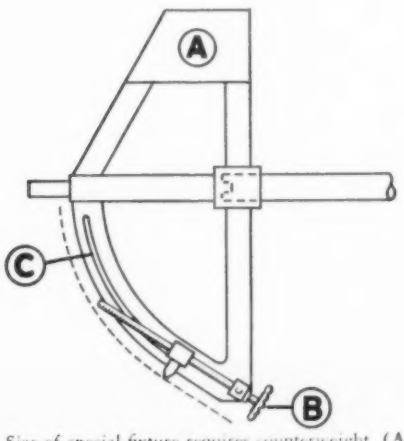
How would you finish in a 14½' x 14½' x 7¼'



a spherical radius cast steel workpiece?



Casting is set up on edge, and 8" I-beam tripod welded to support it. Jacks are used at outer rim for bracing . . . stops are set in floor plate to provide additional rigidity. Special fixture on machine spindle revolves inside casting.



Size of special fixture requires counterweight, (A). As machine spindle revolves fixture, star feed cutter (B), and holder in travel in machine slot in fixture (C) . . . controlled path generates the spherical radius. As operation proceeds toward center of bell, it is necessary to change the length of the actuating screw to avoid interference with the casting.

This unusual job on a 38,000-lb. blast furnace bell is simplified by use of a G&L 560-F floor type Horizontal Boring Mill

A versatile G&L machine, relatively inexpensive tooling and ingenuity . . . here's how they provided an answer to an unusual problem.

William B. Pollock Company of Youngstown, Ohio, took full advantage of the G&L floor type's open construction and excellent versatility.

First of all, they designed a somewhat unusual setup. The circular rough finished casting is set on edge facing the machine's main spindle. Eight-inch I-beams welded to the casting's top and extending to the floor act as braces. Jacks and stops are also used to keep the bell rigid.

After a 2¾" pilot hole is drilled and bored through the center of the top of the bell, a hardened bushing is inserted. This bushing serves as a pilot for the extension of the special fixture. The latter (see illus. lower right), is essentially a star feed tool with the tool holder traveling in a machined slot in the fixture. Its movement controls the path of the tool and generates the spherical radius. Stock removal varies from ¼" to 1½", depending on the concentricity of the rough casting.

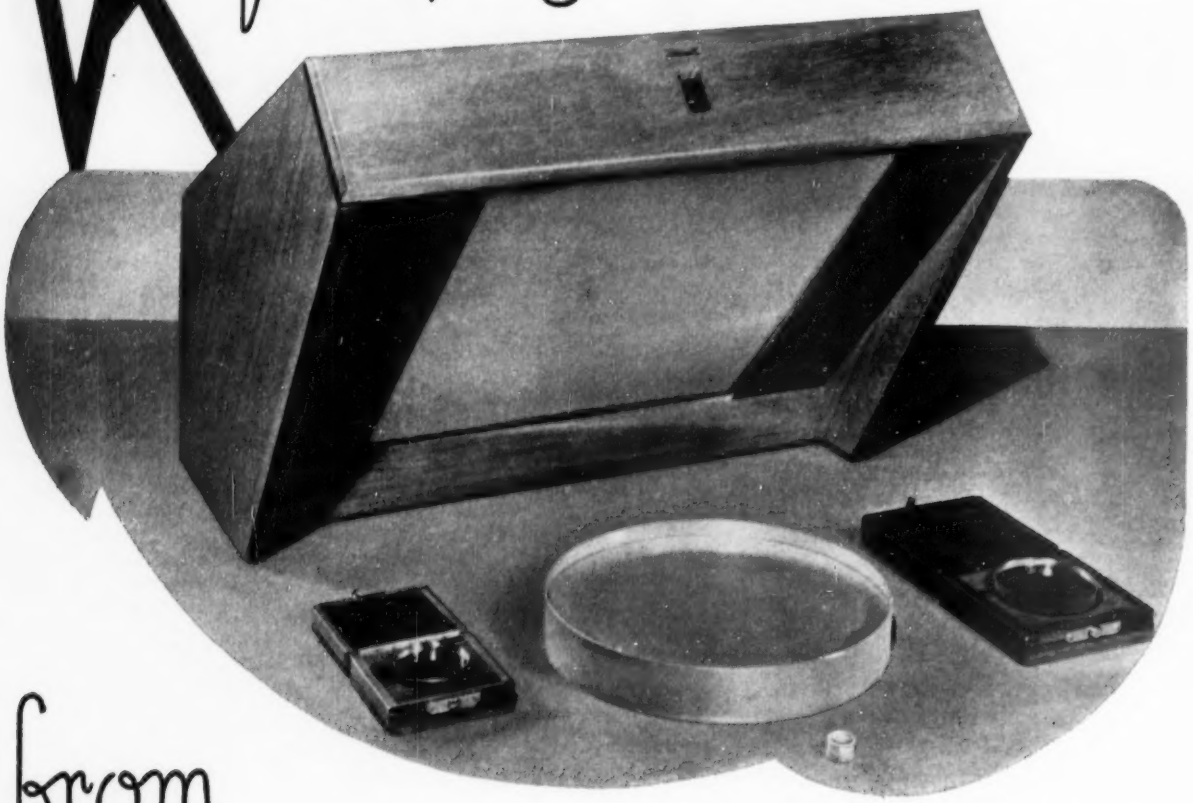
In the photo, you will note the large unfinished portion in the center of the casting. It will be finished after the larger diameter has been finished to depth. This is done to remove surface imperfections such as the one appearing above the operator's head in the photo. To complete the job it's necessary to use a longer actuating screw to push the tool around to that part of the cam track.

If you, like William B. Pollock Co., face unusual production problems, call in your G&L representative. He'll be pleased to help you solve them . . . tell you how you can take advantage of the 5-point G&L analysis service. BUT DON'T DELAY . . . DELIVERY ON G&L MACHINES MAY BE BETTER THAN YOU THINK.

GIDDINGS & LEWIS MACHINE TOOL CO.
Fond Du Lac, Wisconsin, U. S. A.

Builders of the world's finest Horizontal Boring, Drilling and Milling Machines — table, floor and planer types: Hypro Planers, Planer Type Milling Machines and Vertical Boring Mills: and G&L machine tool accessories.

VK fused quartz OPTICAL FLATS



from
½" diameter up . . . .
accurate to .000001"

With VK Optical Flats, close checking of flat surfaces is simplified and more conveniently handled.

Shown here is the new Van Keuren monochromatic light, 22¼" wide, 17¼" high and 20" deep (in bench space). It is designed for use with large optical flats such as the one shown—a 10" diameter fused quartz double-surface master flat (accurate to .000001" both sides).

VK Optical Flats are available in sizes from ½" diameter to 10" diameter in .000001", .000002" or .000004" accuracy. They can be shipped within 30 days from order.

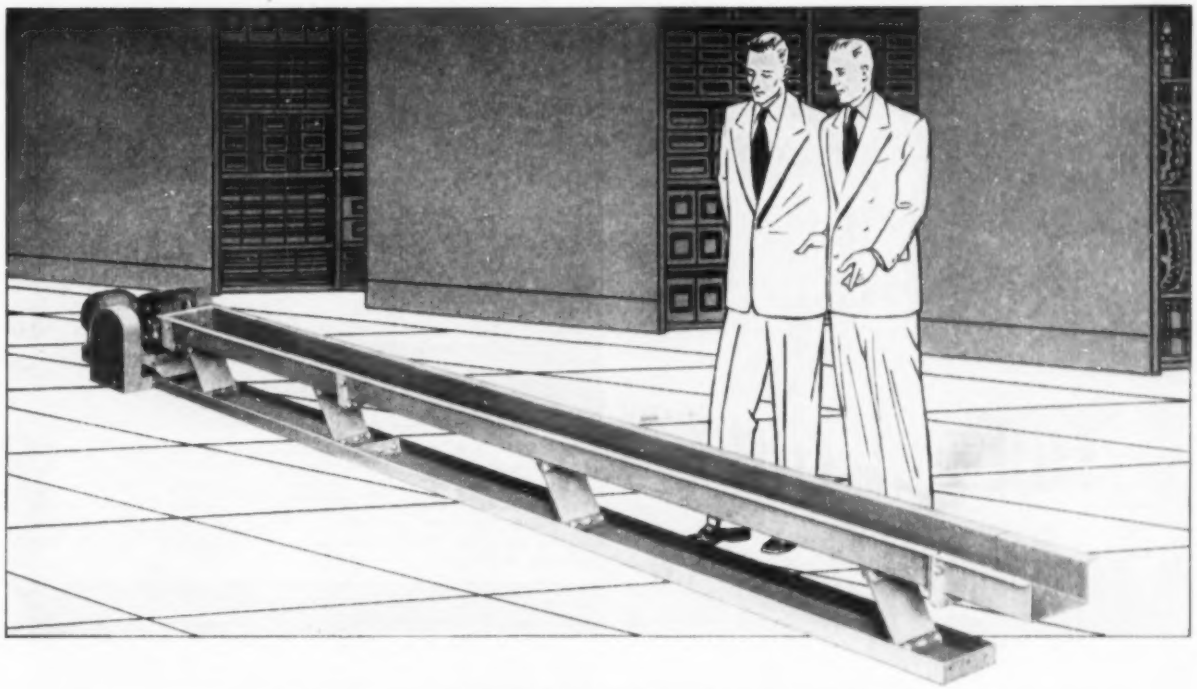
Catalog and Handbook No. 35 is available by writing: The Van Keuren Co., 173 Waltham St., Watertown, Mass. Ask for your copy.

VK
34th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires



Now you can buy FLEXMOUNT Oscillating Conveyors

"right off the shelf"

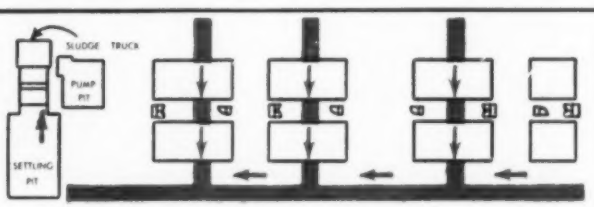
Stock sections make FLEXMOUNT Positive-Action Conveyors easy to order . . . easy to install

Yes, you can now get FLEXMOUNT Oscillating Conveyors for immediate delivery from stock. There's no more waiting for special engineering—stock sections are easily built up to any length desired.

This off-the-shelf service applies to 8, 12 and 18 in. trough widths. For greater capacities, Link-Belt has heavy-duty designs. All offer lower handling costs in carrying off and collecting chips, turnings, punchings, stampings, blasting shot.

Compact, leakproof design makes FLEXMOUNT ideal for moving coolant-soaked chips. Handles bolts, bars, broken tools, even rags without jamming. If desired, dividers can be installed to convey simultaneously two or more types of materials without mixing.

Versatile, low-cost FLEXMOUNT Conveyors are easily kept clean, can be made dust-tight if desired. For all the facts, write for your copy of new Book 2478.



To eliminate manual handling from chip-removal operations, new engine plant has made wide use of FLEXMOUNT. Conveyors beneath machines empty into main conveyor which carries chips and oil to collection point.

How Positive Action moves material...

Positive-action, constant-stroke eccentric drive provides a powerful, yet gentle upward and forward oscillating motion. Large volumes of material are moved in a uniform, continuous flow, regardless of surges. Natural spring action of resilient legs reduces power requirements to a minimum.

LINK-BELT

12,900-A

FLEXMOUNT OSCILLATING CONVEYORS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.

In grinding...

You get the "TOUCH OF GOLD" from Norton

Norton grinding and lapping machines add value and profit to everything they produce

Only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower costs. Norton really gives you the "Touch of Gold" that increases product value and adds to product profit.

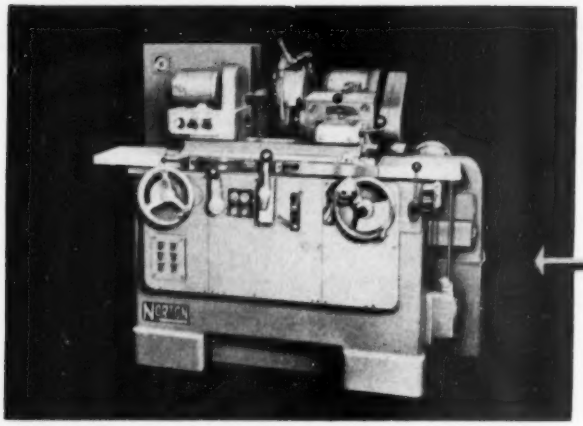
Take advantage of this experience to discuss with us your present grinding problems or your post-emergency production to fit tentative delivery schedules into your future plans.

To Economize Modernize With **NEW**

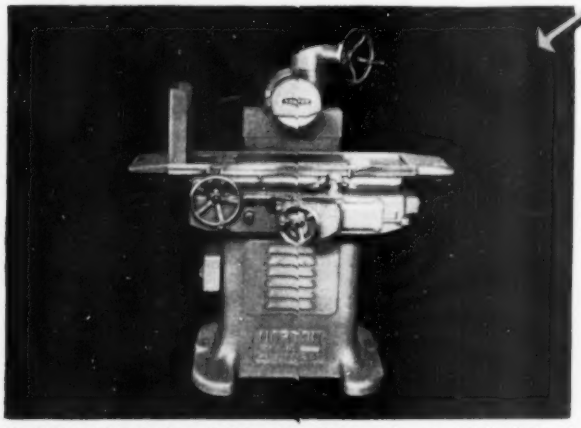
NORTON

GRINDERS *and* LAPPERS

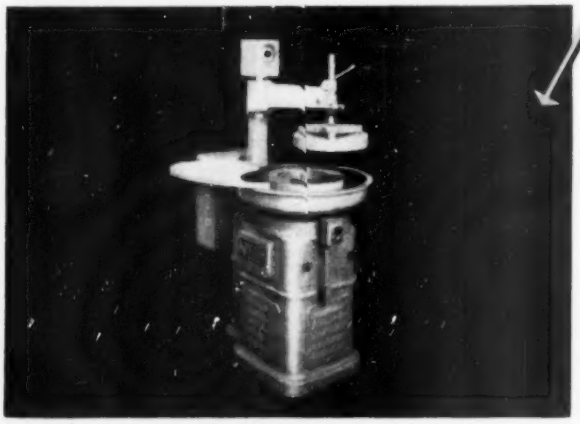
Making better products to make other products better



NEW NORTON 4" TYPE CTU Semiautomatic, in 12" and 18" work-length capacities, rounds out the Norton Cylindrical Grinder Line. Like the larger 6" and 10" CTU's, it offers you a unique combination of speed, accuracy, flexibility and sturdiness. All Norton CTU Semiautomatics have "one lever" control of automatic time cycle which reduces operator attention merely to loading and unloading. *Catalog No. 531* gives you all details.



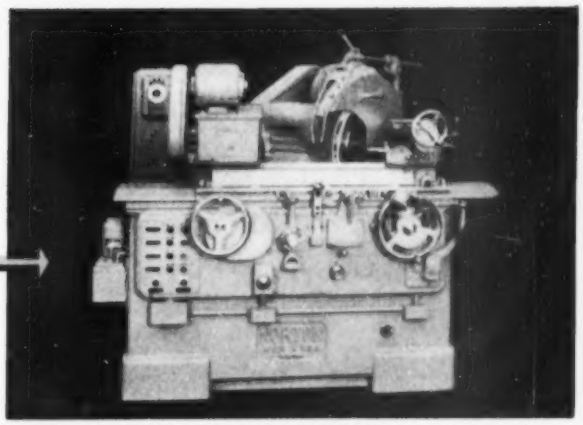
NORTON HYDRAULIC SURFACE GRINDERS, designed with both hand and hydraulic table traverse and cross feed, produce plane surfaces smoothly and speedily. Convenient controls and easy accessibility keep operating and maintenance time low. Such extras as a permanent magnet or direct current type chuck, wet grinding attachment or individual dust exhaust system help make a good basic machine better. Three sizes: 6", 8", and 10". *Write for Catalogs 954 (6"); 190 (8") and 1745 (10")*



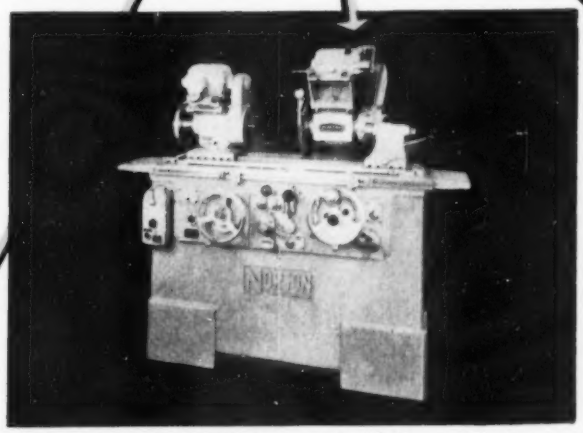
NORTON TYPE 16FC VERTICAL LAPPER produces either flat or cylindrical work to a high degree of dimensional accuracy, parallelism and finish. Widely used for such work as diesel injector parts, plug gages, size blocks, sides of small bearing races, pump gears and plates and other parts. Other Norton lappers are available. *Write for Catalog 212 and General Catalog 1843.*

Norton Grinders and Lappers

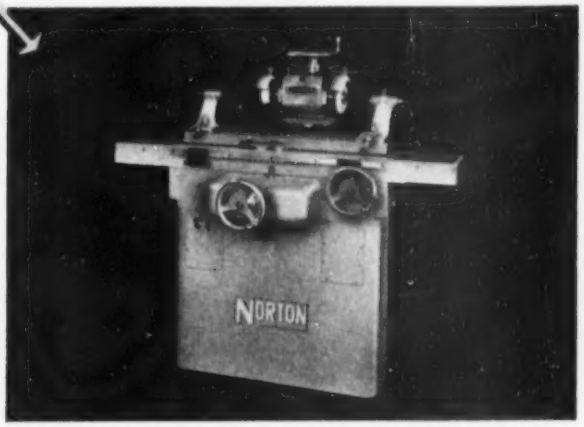
The world's most complete line



NORTON ANGULAR WHEELSLIDE GRINDERS are semiautomatic machines which simultaneously grind thrust surfaces and adjacent diameters to finest accuracy and finish. By eliminating the need for an extra operation, they cut over-all production costs. "One lever" control of automatic time cycle, as in CTU's, helps operators produce more with less effort. Two sizes: 6"x18" and 10"x36". *Catalogs No. 533 (6"x18") and 1793 (10"x36")* give you more information.



NORTON UNIVERSAL GRINDERS are so flexible they handle almost an endless variety of jobs. Compound swivel arrangement allows you to set and feed the wheel at any angle. External, internal, face or angular wheelslide operations come easy with Norton Universal Grinders. Four sizes: 10"x20" and 12", 14", or 16", each with work length capacities of 36", 48", or 72". *Write for Catalogs 170 (10"x20") and 1668 (12", 14", 16").*



NORTON NO. 20 CUTTER AND TOOL GRINDER, with its tilting wheel head, is the most versatile machine in its class. Wheel head tilts 15° above or below horizontal . . . may be swivelled 360° in a horizontal plane. Integral motor cartridge type spindle, duplicate controls for front or either-side operation are other features that make this machine first choice for toolroom grinding. *Write for Catalog 189.*

ONLY NORTON OFFERS YOU OVER 50 YEARS OF COMBINED EXPERIENCE IN:

Abrasives and Grinding Wheels

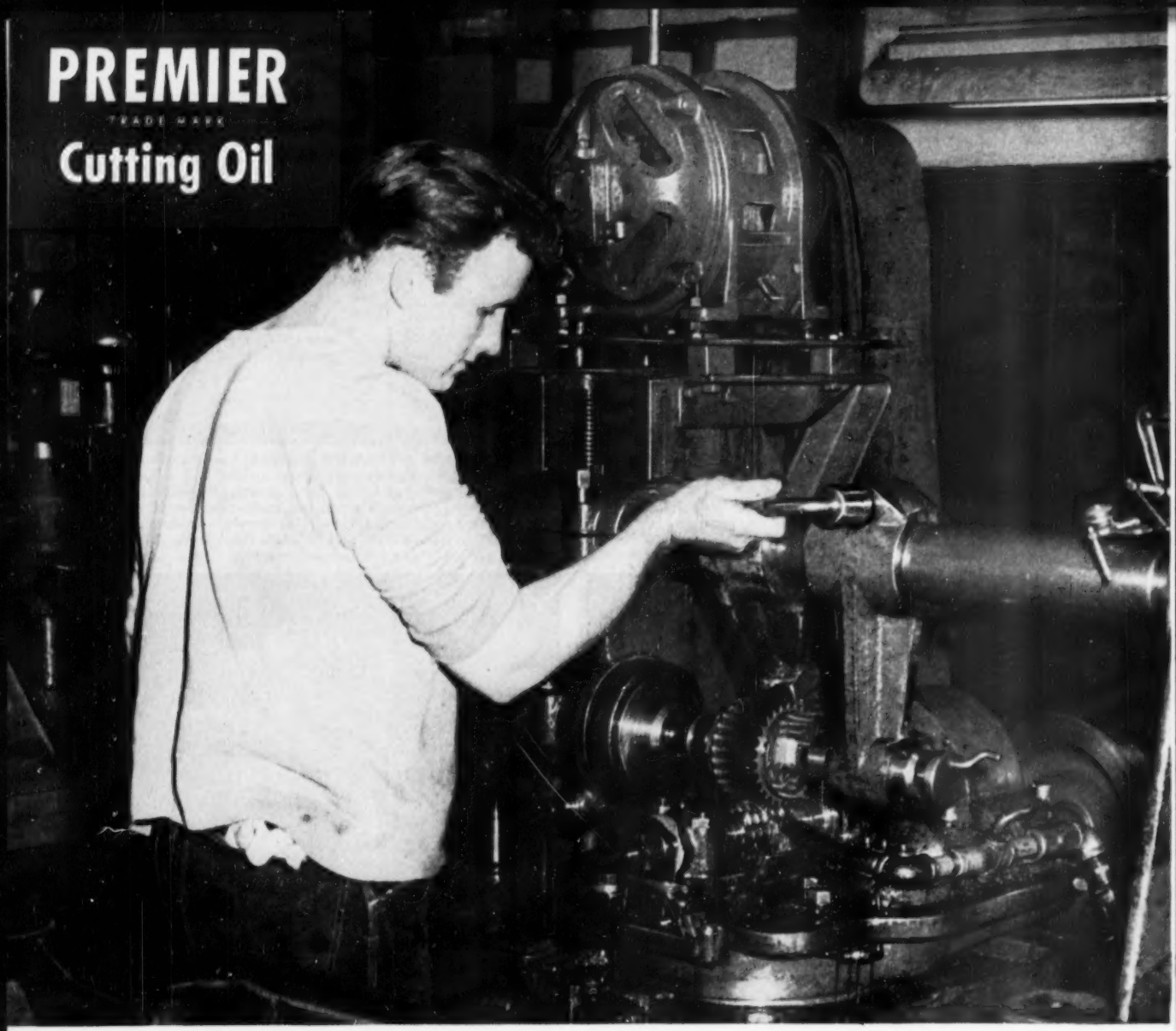
+

Machines for Cylindrical Grinding • Surface Grinding • Cylindrical and Flat Lapping • Universal Tool and Cutter Grinding • Universal Multipurpose Grinding • Specialized Grinding • Crankshaft Grinding • Cam Shaft and Contour Grinding • Roll Grinding.

NORTON COMPANY • MACHINE DIVISION • WORCESTER 6, MASS.

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit

In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5



Hob life increased 75%

● The Gear Products Company, St. Louis, Missouri, tried various cutting oils for the hobbing of door latch spur gears from a free machining steel. With the best of the oils, an average of only 600 pieces could be produced before hobs required sharpening.

A Standard Oil lubrication specialist recommended PREMIER Cutting Oil, a light-colored, sulfurized cutting fluid. With the use of PREMIER, an average of 1050 pieces have been produced before hobs have required sharpening—a 75% increase of hob life. Less downtime for tool changes has resulted in higher production. Fewer sharpenings have significantly reduced tool costs.

The Gear Products Company, specializing in precision gears, gear trains, now uses PREMIER Cutting Oil for the majority of its gear cutting jobs. This has simplified both stocking and application of cutting oil.

Whether you have a specified problem or are looking for better results, there's a good possibility that a Standard Oil lubrication specialist can help you. His experience and special training are backed by one of the finest and most complete lines of cutting oils and lubricants on the market. You can contact him easily by phoning your local Standard Oil (Indiana) office. Or write: Standard Oil Company, 910 S. Michigan Avenue, Chicago 80, Ill.

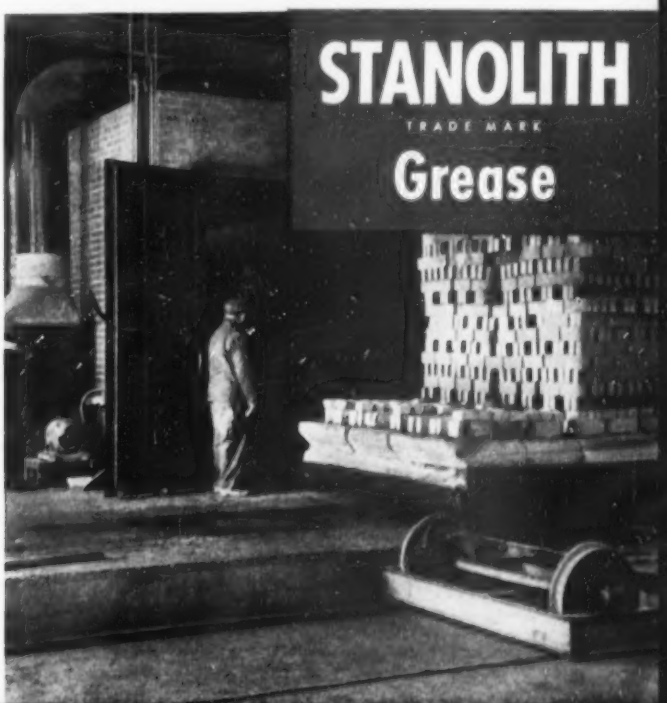
What's YOUR problem?

Fred. H. Moulton, lubrication specialist in Standard Oil's St. Louis office, worked closely with the Gear Products Company to help them get significantly greater tool life on the hobbing job described at the left.

To help you get better results with cutting oils and lubricants, Standard Oil has a corps of lubrication specialists located throughout the Midwest. One of these men is near your plant. He will give you the assistance you need when you need it. His wide experience and special training in the use of modern lubricants and cutting fluids will help you make real savings. You can reach him quickly and easily by phoning your local Standard Oil Company office. His services are backed by a supply set-up that is unique in the oil industry and that can mean convenience and savings for you.

Polishes off lubrication troubles! The automatic buffing machine, shown above, represents the engineering ingenuity of the McGraw Electric Company's Toastmaster Products Division, Elgin, Illinois, who designed the machine. Represented, too, in the successful operation of this equipment, is the work of a Standard Oil lubrication specialist. When various lubricants failed to give satisfactory lubrication of conveyor bearings, the Standard lubrication specialist came up with the answer: STANODRIP Dripless Oil. STANODRIP has stopped corrosion and gumming troubles and has reduced bearing wear to a minimum.

Stops high temperature troubles, cold! A midwest company was sweating out a problem of lubricating kiln car wheel bearings. Kiln oven temperatures approached 2000° F. and bearing temperatures were around 400° F. Greases tried on the job broke down to form carbon and gummy deposits. Recommended by a Standard Oil lubrication specialist, STANOLITH Grease has stopped troubles, cold! Carbon and gum troubles have been eliminated. Continuous use of kiln cars has permitted greater production.



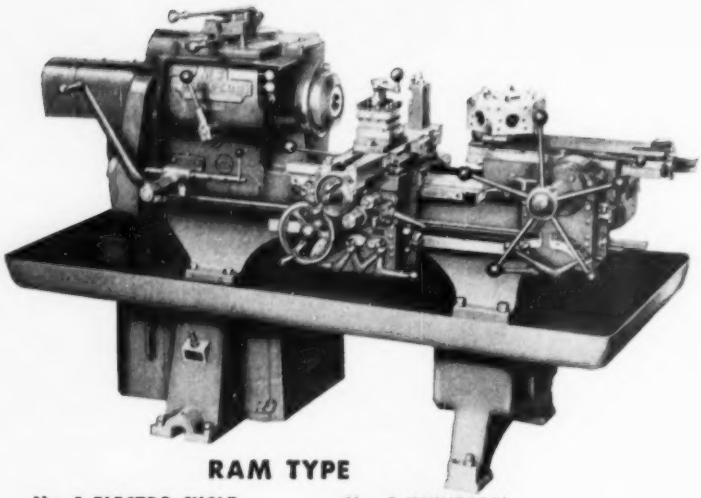
STANDARD

STANDARD OIL COMPANY
(INDIANA)

TURRET LATHES

Warner & Swasey Turret Lathes are built in sizes and capacities to handle a wide range of jobs. Each machine is specifically designed for its rated bar or chucking capacity.

They are recognized everywhere for their ruggedness and extreme precision, and known for their high productivity, low upkeep, ease of operation, and dependability in holding built-in accuracy over a long period.



RAM TYPE

No. 1 ELECTRO-CYCLE
Bar Capacity 5/8"—Swing 11"

No. 2 ALL-GEARED HEAD
Bar Capacity 1"—Swing 14"

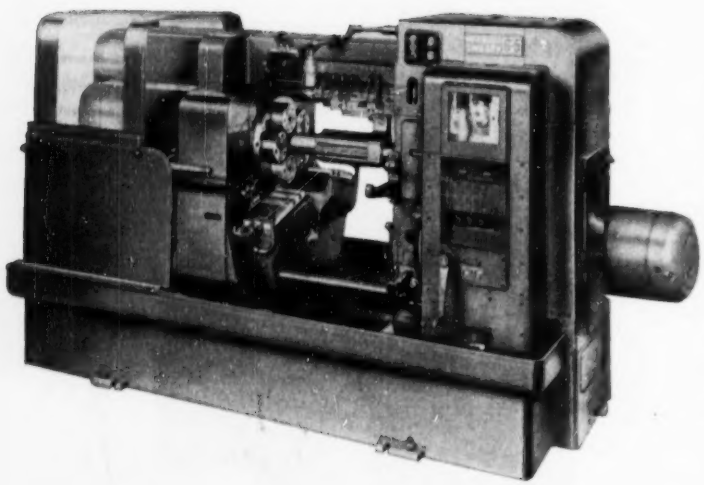
No. 3 UNIVERSAL
Bar Capacity 1½"—Swing 15⅜"

No. 4 UNIVERSAL
Bar Capacity 2"—Swing 18⅛"

No. 5 UNIVERSAL
Bar Capacity 2½"—Swing 20"

LOOK TO WARNER & SWASEY

FOR YOUR

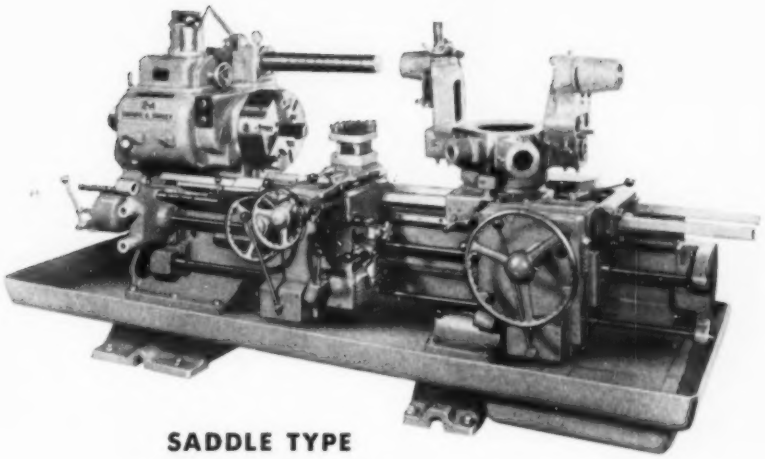


5-SPINDLE AUTOMATIC MACHINES

M-2500 Bar Capacity 1¾"
M-2530 Bar Capacity 2¼"
M-2540 Chuck Swing 6"
Turning Stroke 0-5"

Small and medium lots as well as long runs are now practical on an automatic basis because of the quick setup of these Warner & Swasey 5-Spindle Automatics. Patented "Quick-Set" Quadrants for adjusting feed strokes and cross slide strokes make setup easy and fast, eliminate all cam change worries. Now you can increase your production in less floor space—mass produce uniform, high precision parts at lower cost with these Warner & Swasey Automatics.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY



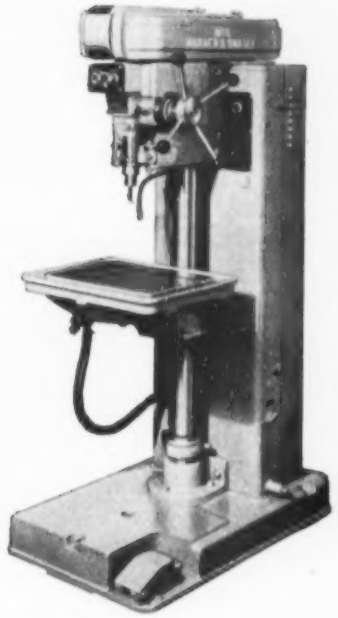
SADDLE TYPE

1-A UNIVERSAL HEAVY DUTY
Bar Capacity 2½" or 3"—Swing 16¼"

2-A UNIVERSAL HEAVY DUTY
Bar Capacity 3½"—Swing 20"

3-A UNIVERSAL HEAVY DUTY
Bar Capacity 4½" or 6"—Swing 23½"

4-A UNIVERSAL HEAVY DUTY
Bar Capacity 8", 9" or 12"—Swing 28¼"



PRECISION TAPPING AND THREADING MACHINES

No. 10 0-80 to 10-24 Capacity
No. 11, No. 11-R 8-36 to ⅞" Capacity
No. 12 ⅜" to 2½" Capacity

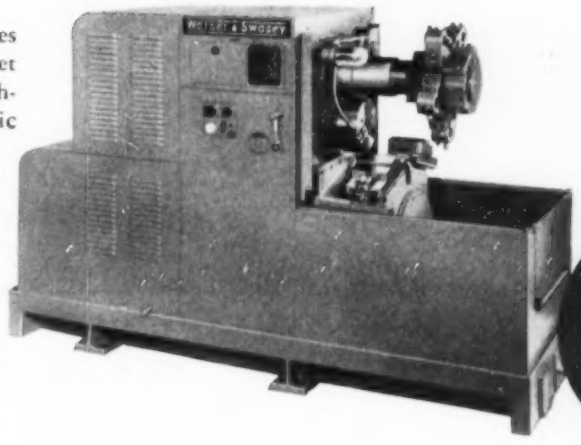
Positive tap lead—solenoid actuated guide fingers operating on a lead screw—produces threads as accurate as the tap itself. Eliminates drag or backlash. Depth can be controlled within one-tenth revolution of the tap. Also cuts left hand and external threads. Speed changes easily made. Setup quick and easy.

TURNING NEEDS

SINGLE SPINDLE AUTOMATIC CHUCKING MACHINE

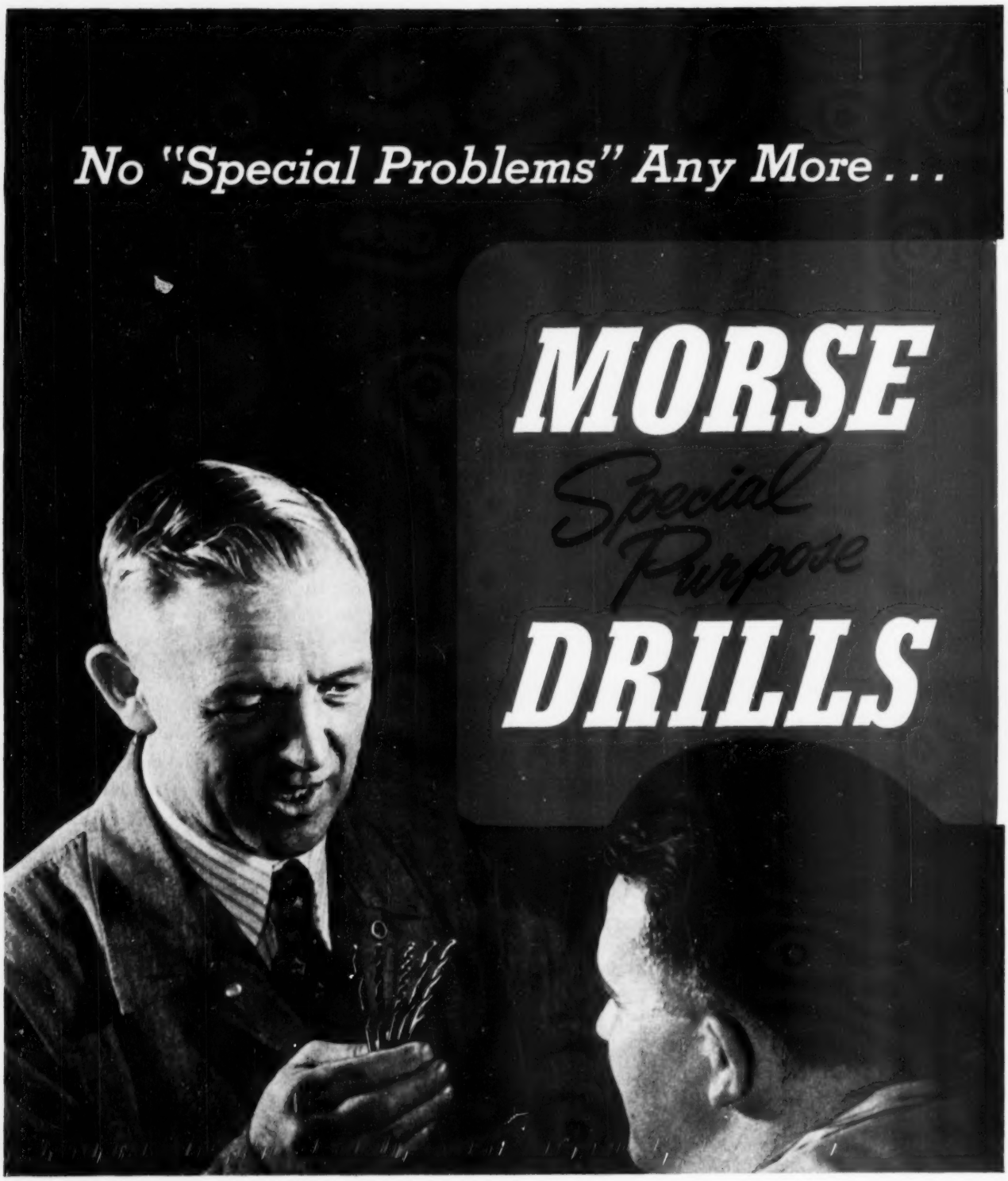
**8½" Swing over cross slide—
6" working stroke**

Sets up fast—like a turret lathe. Uses turret lathe tools and machines turret lathe lots on an automatic basis, without the usual penalties of automatic operation. And the 1-AC will combine certain operations not possible in accepted turret lathe practice, reducing machine time. Automatically changes feeds and speeds under cut for more efficient use of cutting tools. Requires less skill to operate, and in many cases one man can handle two or more machines.



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY



MORSE

with these

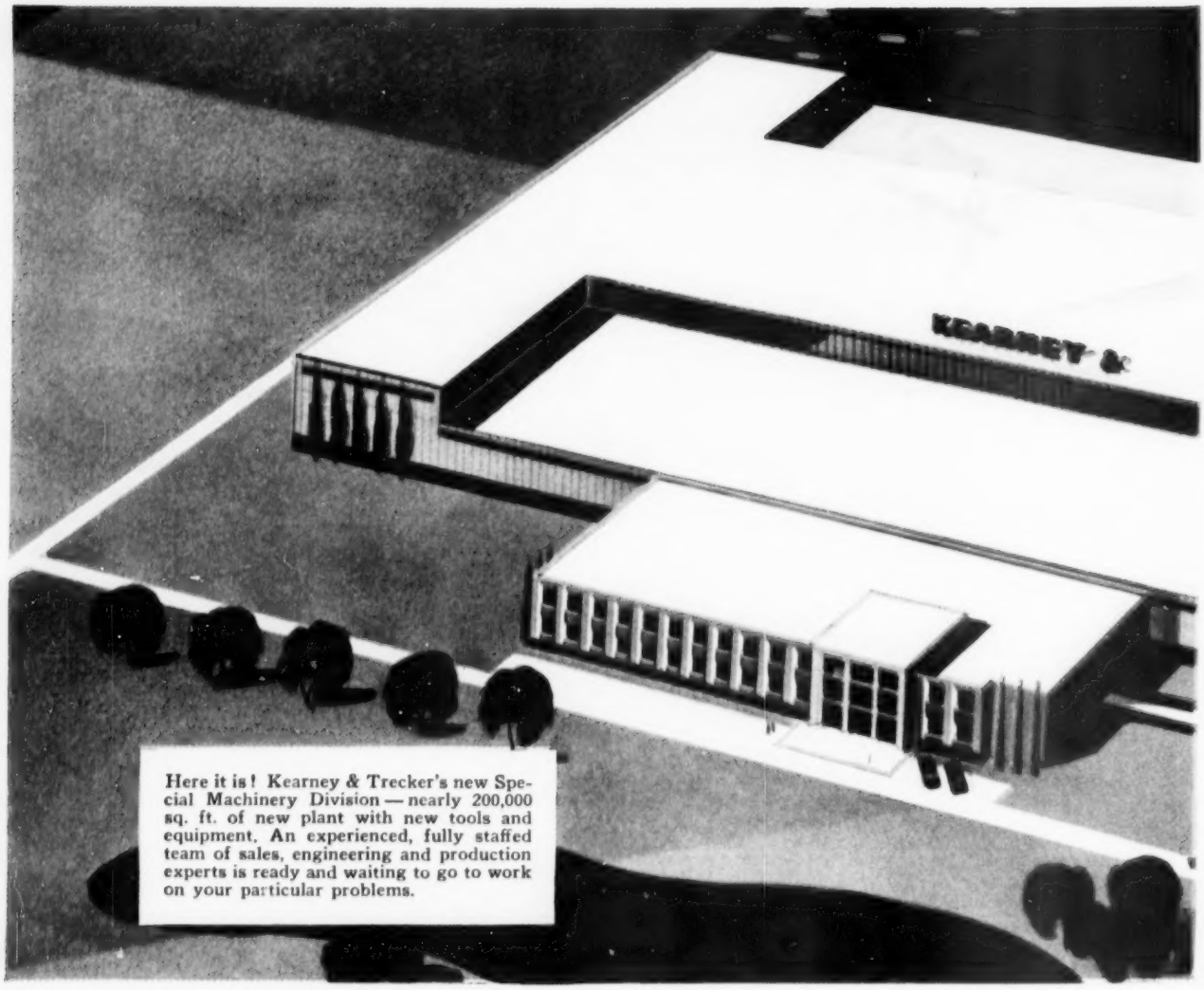
Take another good look at that range of applications for the 5 types of drills listed above. Now what's so tough about any "special job", when you can get all these Morse Special-Purpose Drills . . . and others besides . . . from your Morse-Franchised Distributor *right now?*

Call him in today, and ask him what he recommends for that job of *yours.* He has the stock, the know-how . . . and the full backing of Morse engineers . . . to trim your "unusual" drilling problems down to size, both in performance and costs. *It's your move . . . and you can't lose!*

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASS.
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

Cutting Tools

Buy them by phone from your Morse-Franchised Distributor and save ordering time



Here it is! Kearney & Trecker's new Special Machinery Division — nearly 200,000 sq. ft. of new plant with new tools and equipment. An experienced, fully staffed team of sales, engineering and production experts is ready and waiting to go to work on your particular problems.

INCUBATOR...for Production

This plant is being built for you . . . to engineer *new* production methods – to build the large or small special machines, tools and fixtures you need to improve production and cut costs.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Production behind schedule?
Costs going up, up and up?

Will special machines, special tools and fixtures or special arrangements of standard machines help you solve these problems?

Then why not be among the first to take advantage of the 5-million-dollar-plus investment that Kearney & Trecker is making in new plant, new tools and new engineering to help you solve them.

Kearney & Trecker *is no newcomer* to the field of special machine tools and allied special equipment. There are literally millions of dollars worth of Kearney & Trecker special machinery in plants all over the world. Equipment built over the period of more than 50 years of Kearney & Trecker's existence. And that doesn't include the 60,000

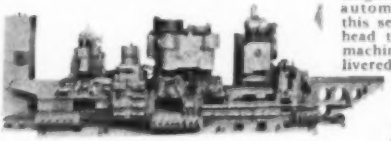
Ideas

Kearney & Trecker standard milling machines and other machine tools so well known and so widely accepted everywhere.

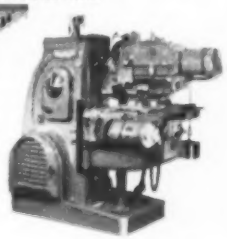
Kearney & Trecker is already working on new production ideas, new equipment and tool designs to be produced in this plant. Kearney & Trecker Special Engineering and Methods Analysts are ready right now to serve you with (1) Prompt response to your inquiry, (2) Immediate engineering help on your problem, plus, (3) The newest, finest and most complete facilities to build the special equipment you need — big or small.

Phone, write or wire The Special Machinery Division, Kearney & Trecker Corporation, Milwaukee 14, Wis., today. Get the facts about Kearney & Trecker's Special Machinery Division and how it can serve you.

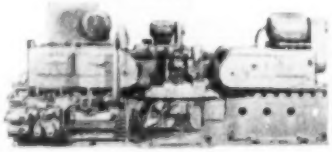
HERE ARE SOME OF THE MACHINES KEARNEY & TRECKER HAS BUILT:



Engineered and built for an automotive manufacturer, this seven-station traveling head transfer-type milling machine is one of five delivered in 1952.



Special knee-type cam milling machine — the first of twelve such machines to be built for the nation's largest manufacturer of shoe-making machinery.

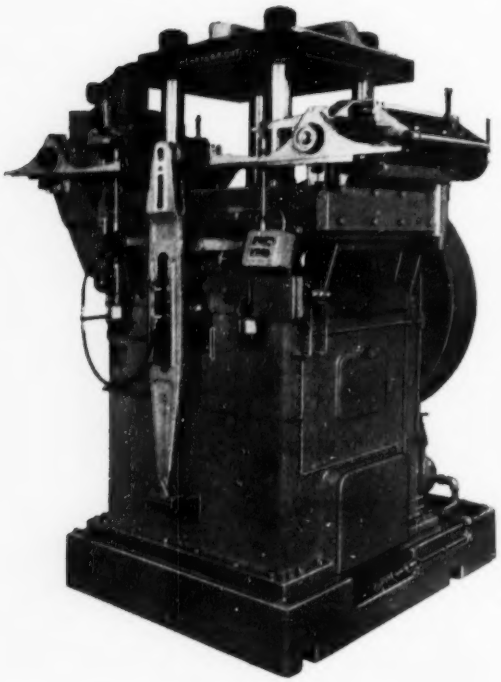


This huge four-station rotary indexing machine, built for major automotive manufacturer, is equipped with three horizontal milling heads.

Here is a partial list of the machines that will be built:

- Standard and special bed type milling machines.
- Special index milling machines.
- Special transfer milling machines.
- Special index or transfer machines involving a combination of milling, boring, drilling or tapping to perform all operations on a workpiece.
- Special machines for the automotive, aircraft and farm implement industries.
- Special boring machines.
- Rise and fall milling applications.
- Modified standard and special knee-type milling machines.
- Special tooling for standard milling machines.

A PROFIT WITH EVERY STROKE



Our customers say that. It figures. One Dieing Machine does the work of five to ten conventional stamping presses. One stroke—a complete part. One inspection. One trip for parts removal. Speed—you can pull out the throttle. Die life—longer for two reasons. (1) Stability, minimum vibration, extreme precision of tools alignment. (2) Dies take less of a beating; less metal needs to be removed for sharpening. Our men can give you the whole Dieing Machine story. If you want to cut costs, now's the time to talk to one of them—a note from you will have an H & W man on deck promptly.

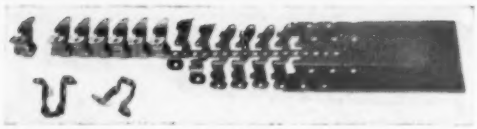
NEW CATALOG Up-to-the-minute facts on Dieing Machines. Capacities now range from 25 tons to 2500 tons. Catalog gives specifications up to 400-ton machine. Write Henry & Wright, 481 Windsor St., Hartford, Connecticut.

HENRY & WRIGHT

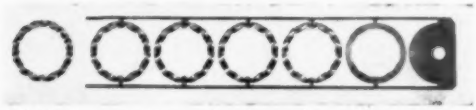
DIVISION OF EMHART MFG. CO.

HARTFORD 1, CONNECTICUT

TYPICAL JOBS THAT SHOW A PROFIT AT EVERY STROKE



Automotive stamping produced complete per stroke from 3/32" thick by 13" wide hot rolled steel in coils on 200-ton Dieing Machine, single gear type, equipped with progressive die. Speed approximately 45 strokes per minute.

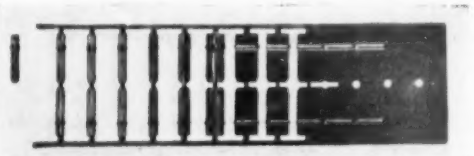


Ball bearing retainer produced complete in 75-ton Dieing Machine operating at speed of 95 strokes per minute. Made from 4 3/8" wide by .034" thick cold rolled steel.

Ferrule. One completed piece produced per stroke in 50-ton Dieing Machine operating at speed of 90 strokes per minute. Made from 9/16" diameter by 7/8" long by .030" thick cold rolled steel.

C-Clamp Frame. Both halves produced complete in 150-ton Dieing Machine operating at speed of 65 strokes per minute. Material—cold rolled steel .086" by 4 3/8" wide.

Support bracket produced complete one per stroke in 150-ton Dieing Machine operating at speed of 60 strokes per minute. Made from .062" thick by 7 1/4" wide cold rolled steel.



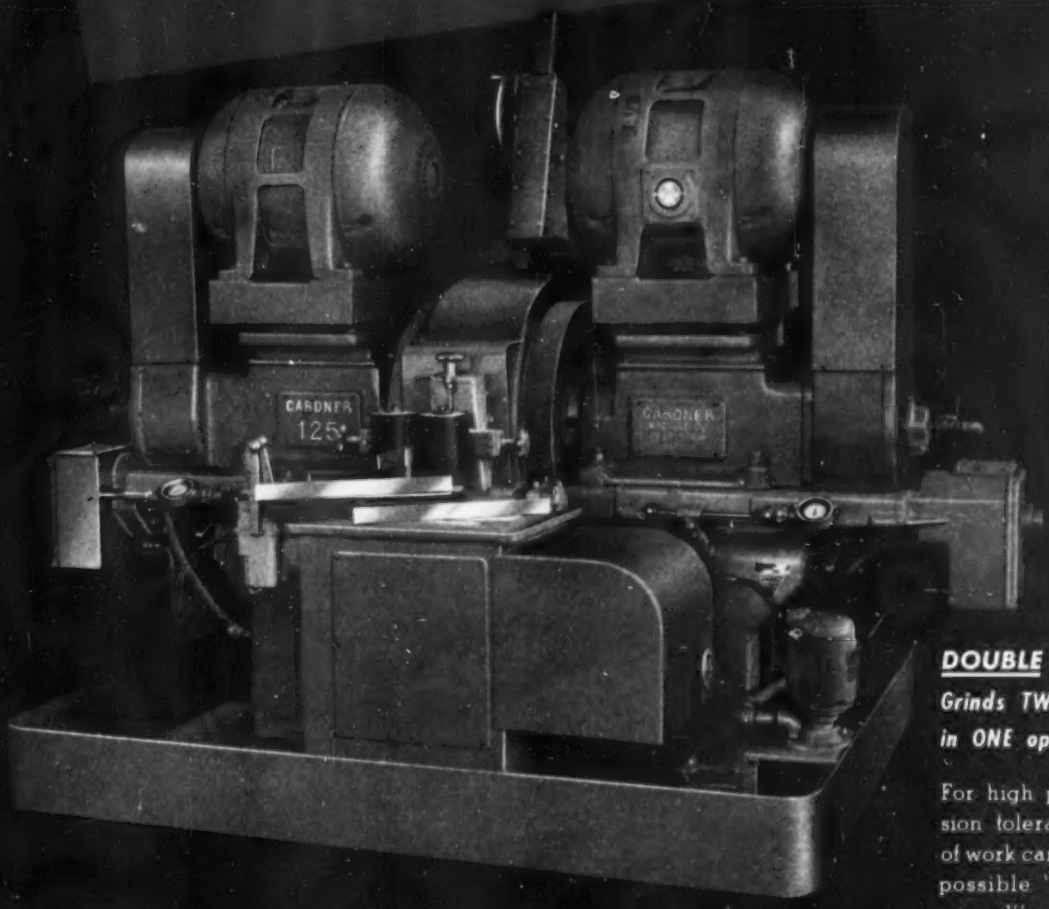
Radio tube prong produced complete in 25-ton Dieing Machine at rate of 450 pieces per minute. Made from brass .012" by 1 7/16" wide.

Bathroom fixture produced in 60-ton Dieing Machine operating at speed of 100 strokes per minute. Made from .032" thick by 1 3/4" wide cold rolled steel.

Hardware item. One completed piece produced per stroke in 100-ton Dieing Machine operating at speed of 75 strokes per minute. Made from 3" wide by .040" thick cold rolled steel.

GARDNER
precision disc Grinders

Three Machines That Will Reduce Your Flat Surface Grinding Costs

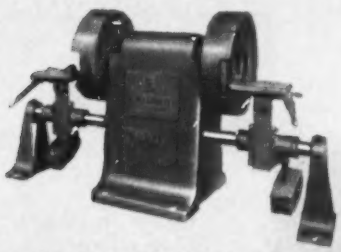


DOUBLE SPINDLE GRINDER

Grinds TWO Parallel Surfaces in ONE operation

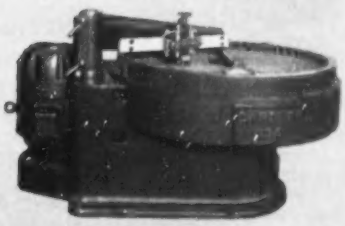
For high production to precision tolerances. Wide choice of work carrying fixtures makes possible "individually engineered" machines at low cost.

SINGLE SPINDLE GRINDER



Gardner No. 226-26" Standard Single Spindle Grinder with hand-operated lever tables on each end. A general purpose machine with wide industry applications.

HORIZONTAL DISC GRINDER



Gardner No. 124-53" Horizontal Disc Grinder used for grinding a flat surface on castings and weldments in a wide variety of sizes and shapes.

No. 119M

GARDNER MACHINE COMPANY

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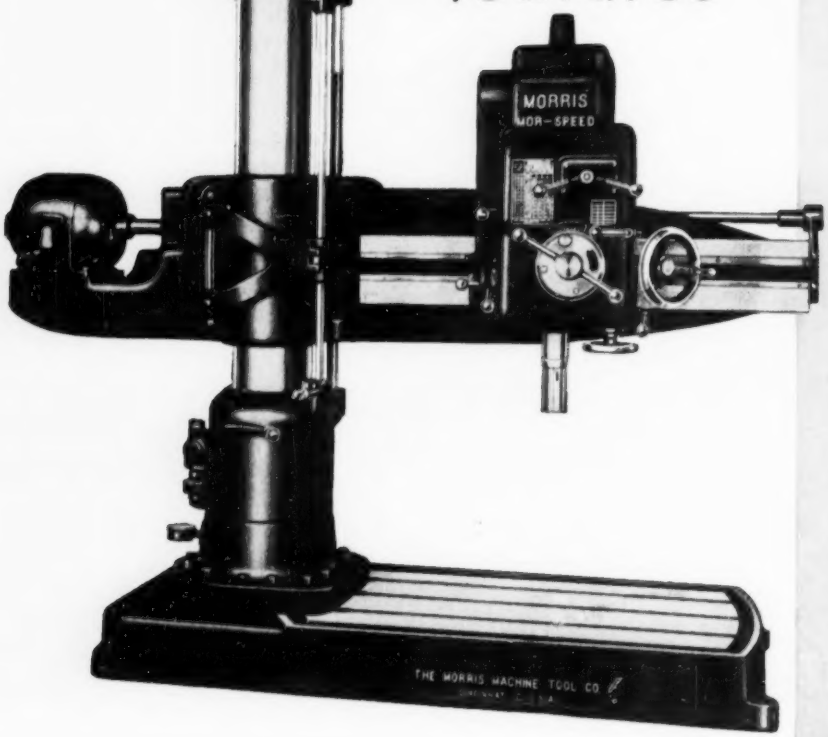
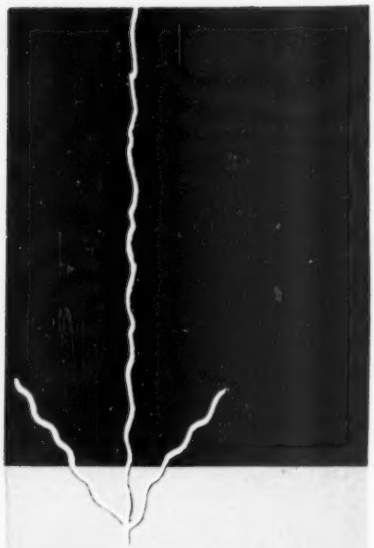
for production or tooling drilling reaming or tapping

Get all these features





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A better job faster because the right combination is easily selected.

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ABRASIVES
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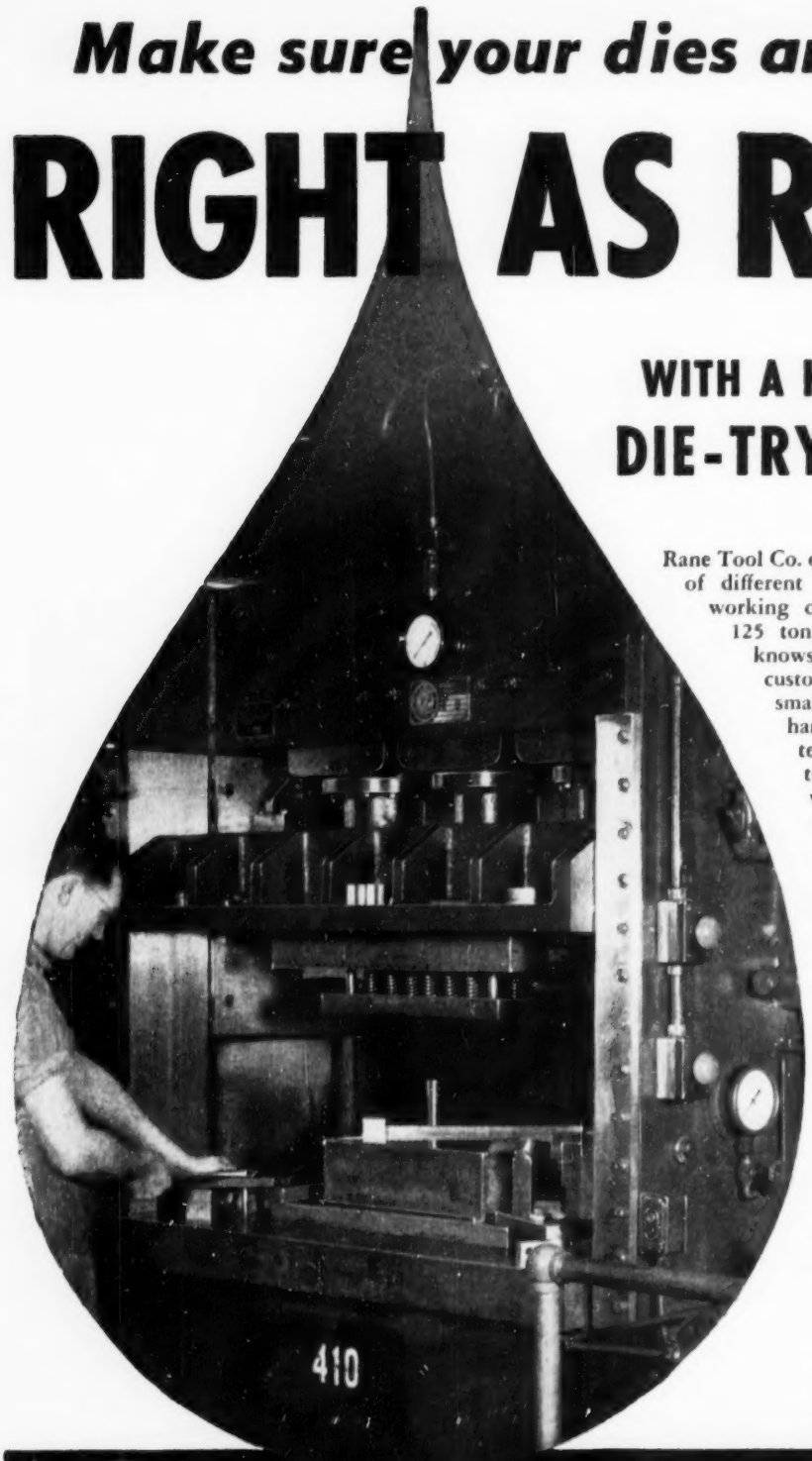
Make sure your dies are always

RIGHT AS RANE!

WITH A KRW HYDRAULIC DIE-TRYOUT PRESS!



Rane Tool Co. of Jamestown, N. Y., makes hundreds of different dies for America's leading metalworking companies. Thanks to their KRW 125 ton, 3-cylinder Hydraulic press, Rane knows their dies will work perfectly in the customer's plant. Some Rane dies are small enough to fit in the palm of your hand; others are big babies that take ten men to lift. And all of them are tried out on this KRW press. It's working 95% of every day. And the Rane people tell us it's the most versatile piece of equipment in their shop.

Whether die-making itself is your business, or whether you make dies for your own production use, a KRW die-tryout Hydraulic press will soon pay for itself in time and money saved. With a KRW press in your machine shop you *know* dies will work in production before they leave the shop. There's a KRW Hydraulic press to meet any metalworking problem. 25 - 150 ton capacities, all self-contained above ground; one, two and three cylinder models; hand operated, air operated or motor driven.

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POWERFUL

No. 12 manufacturing type milling machine

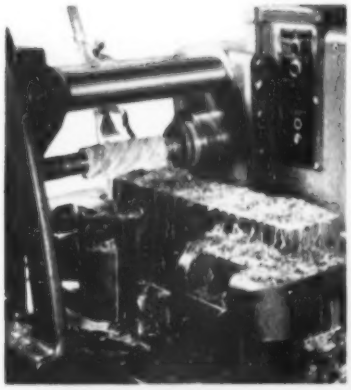
Brown & Sharpe

FULL POWER
BROWN & SHARPE
BROWN & SHARPE
PROVIDENCE, R.I. U.S.A.

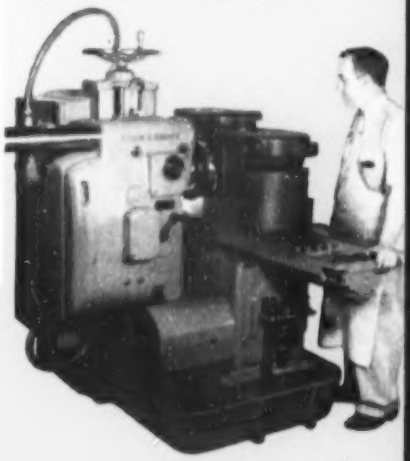
. . . 7½ h.p. at the spindle for extra fast milling on long and short run jobs

Through extra power and simplified operation, this machine gives you important competitive advantages for meeting today's high production schedules.

It allows you to take heavy cuts at fast feeds on a wide variety of medium sized work . . . quick set-ups are assured by many time-saving features. All power movements are electrically controlled giving you exceptionally precise, rapid operation. Dual feed rates, a variety of automatic cycles, and the ability to climb mill in either direction are just a few of its advanced conveniences. Maximum cutting efficiency is assured through a wide choice of feeds and speeds. Write for complete details on the powerful No. 12 Plain Milling Machine — 7½ H.P. Spindle Drive.

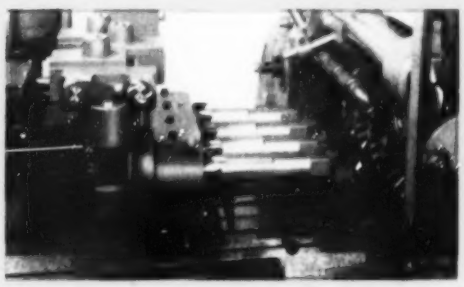


POWERFUL CUT being made on a No. 12, 7½ h.p. Milling Machine. Steel forging is 5" wide and cutter removes ⅛" of stock at a fast feed. Unique high ratio gearing makes faster cutting possible.



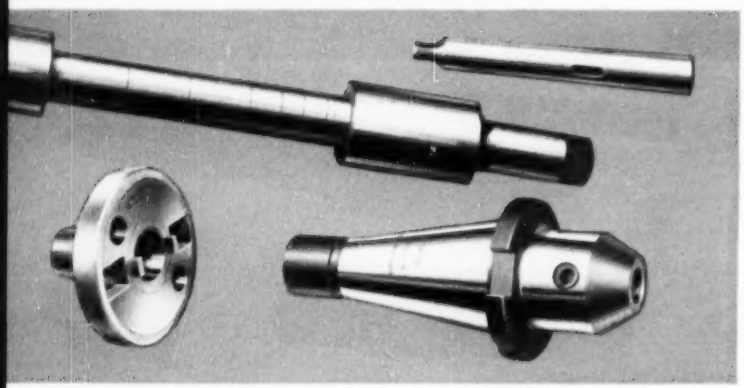
HIGH SPEED MILLING of casting using carbide-tipped face milling cutter. The powerful No. 12 permits taking full advantage of the faster feeds and speeds possible on medium-sized carbide milling jobs.

SPECIAL FIXTURES, like this for automatically indexing and milling squares on taps, make the No. 12 a still higher production machine . . . removal of fixture quickly converts machine for general use. Brown & Sharpe Engineering Service and Facilities are available to you for special applications.



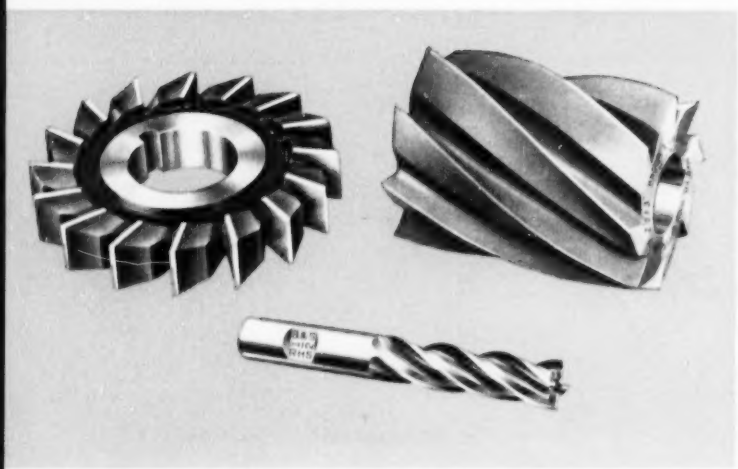
Brown & Sharpe

Keep Milling Efficiency High with these productioneered tools



ARBORS, ADAPTERS, and COLLETS

These arbors, adapters, and collets are made with the same precise care for which other Brown & Sharpe products are famous. Their strength and accurately ground surfaces insure highly efficient milling on all jobs.

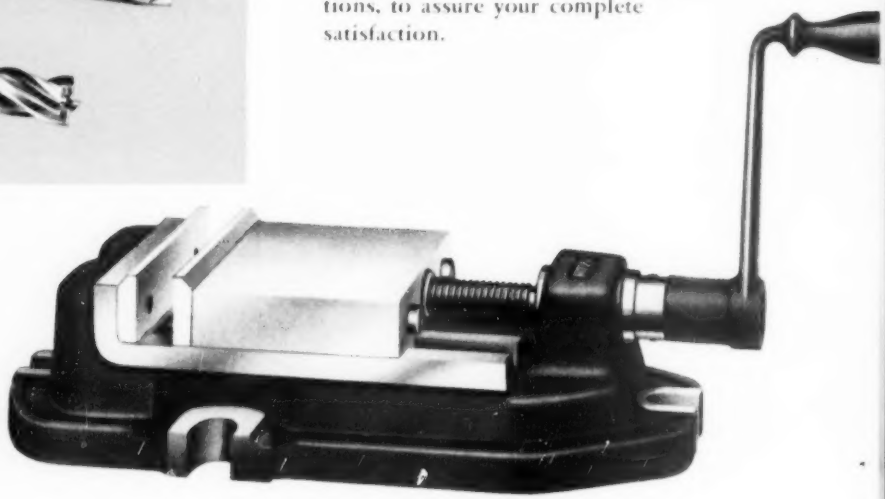


CUTTERS and END MILLS

Brown & Sharpe cutters give you full value for every dollar invested in them. That's why more buyers prefer them. They're made from the finest steels, under scientifically controlled conditions, to assure your complete satisfaction.

VISES

Low in height and rigidly constructed, these precision vises give you maximum work-holding economy. When fitted with special jaws, they often eliminate the need for expensive fixtures.



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BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U.S.A.

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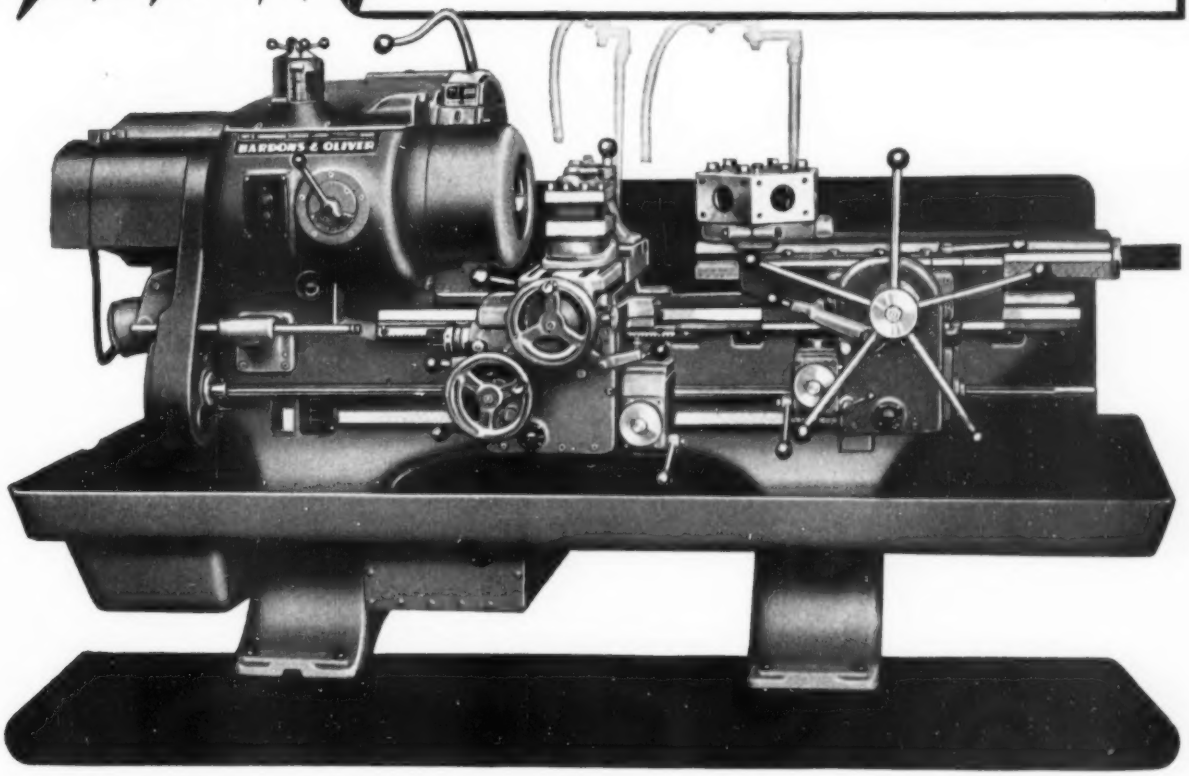
NEW

BARDONS & OLIVER
Extra Capacity
No. 7 Ram Type Universal Turret Lathe
Takes up to 4½" dia. Through The Automatic Collet Chuck



The many improvements include more power, higher speeds, and increased rigidity.

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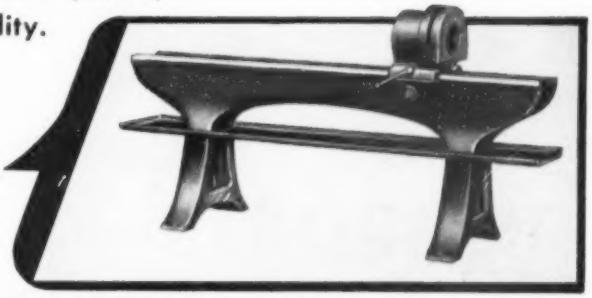
New bar support will adequately handle the weight of 4½" dia. solid bars. Automatic Collet Chuck and Bar Feed are hydraulically actuated.

Complete details on request.



BARDONS & OLIVER, INC.

1134 WEST 9TH STREET • CLEVELAND 13, OHIO

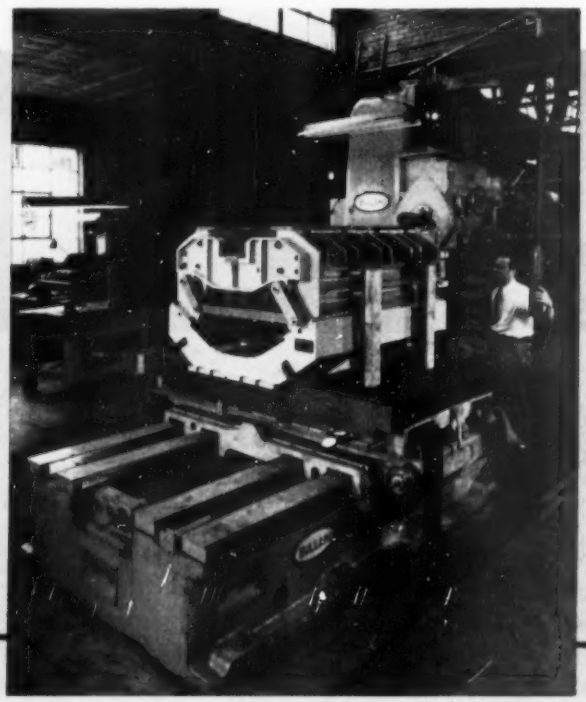
It's ... when considering your new machines, demand

this 4-way bed Bullard Horizontal Boring, Milling and Drilling Machine

At Best Tool and Engineering Company, Detroit, Michigan where they are making Packard Motor Car Co. fixtures for milling upper half of aircraft engine crankcases, they rely upon the ruggedness and accuracy of these Bullard Horizontal Boring, Milling and Drilling machines for the finest of workmanship in their products.

Even though these fixtures are not a production run, Best Tool and Engineering have found that the versatility and reliability of these Bullard machines provide a profitable, precision method for machining.

A satisfied customer is the best proof of a machine's performance and ability.

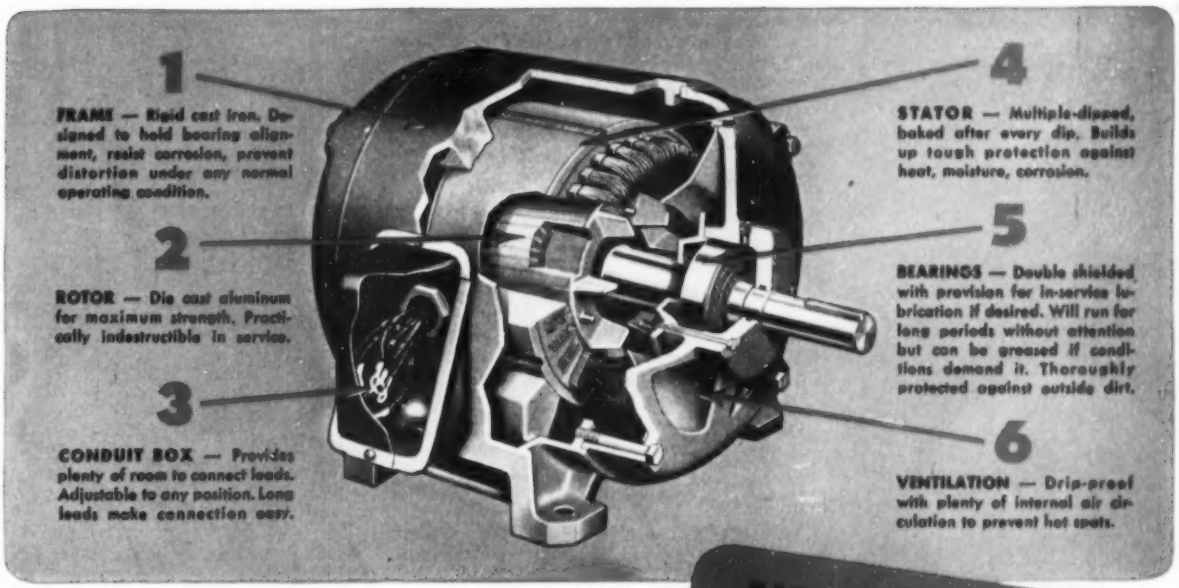


- **Rigidity of BULLARD 4-Way bed CONSTRUCTION**
- **Advantages of BULLARD NON-METALLIC bearing surfaces**
- **Smooth operation from HYDRO-DYNAMIC Coupling Drive**
- **Machine versatility BULLARD inbuilt ACCURACY.**

The **BULLARD** *Company*

BRIDGEPORT 2, CONNECTICUT

Look for These 6 Signs of Good Motor Design


1
FRAME — Rigid cast iron. Designed to hold bearing alignment, resist corrosion, prevent distortion under any normal operating condition.
2
ROTOR — Die cast aluminum for maximum strength. Practically indestructible in service.
3
CONDUIT BOX — Provides plenty of room to connect leads. Adjustable to any position. Long leads make connection easy.
4
STATOR — Multiple-dipped, baked after every dip. Builds up tough protection against heat, moisture, corrosion.
5
BEARINGS — Double shielded with provision for in-service lubrication if desired. Will run for long periods without attention but can be greased if conditions demand it. Thoroughly protected against outside dirt.
6
VENTILATION — Drip-proof with plenty of internal air circulation to prevent hot spots.

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TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

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BALANCED *Action*

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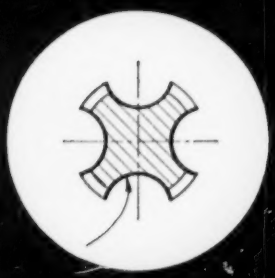
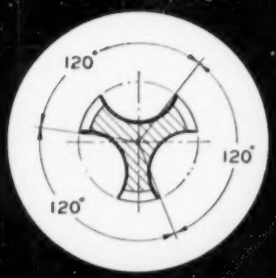
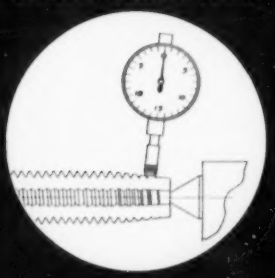


Uniform Flute Contours

Exact Flute Spacing



Accurate and Concentric Chamfers



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NATIONAL REAMERS perform for you at top efficiency in a wide variety of materials. Choose from the types shown here, or from many other types designed for specific uses . . . At cutting your costs—National has the edge!
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CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR
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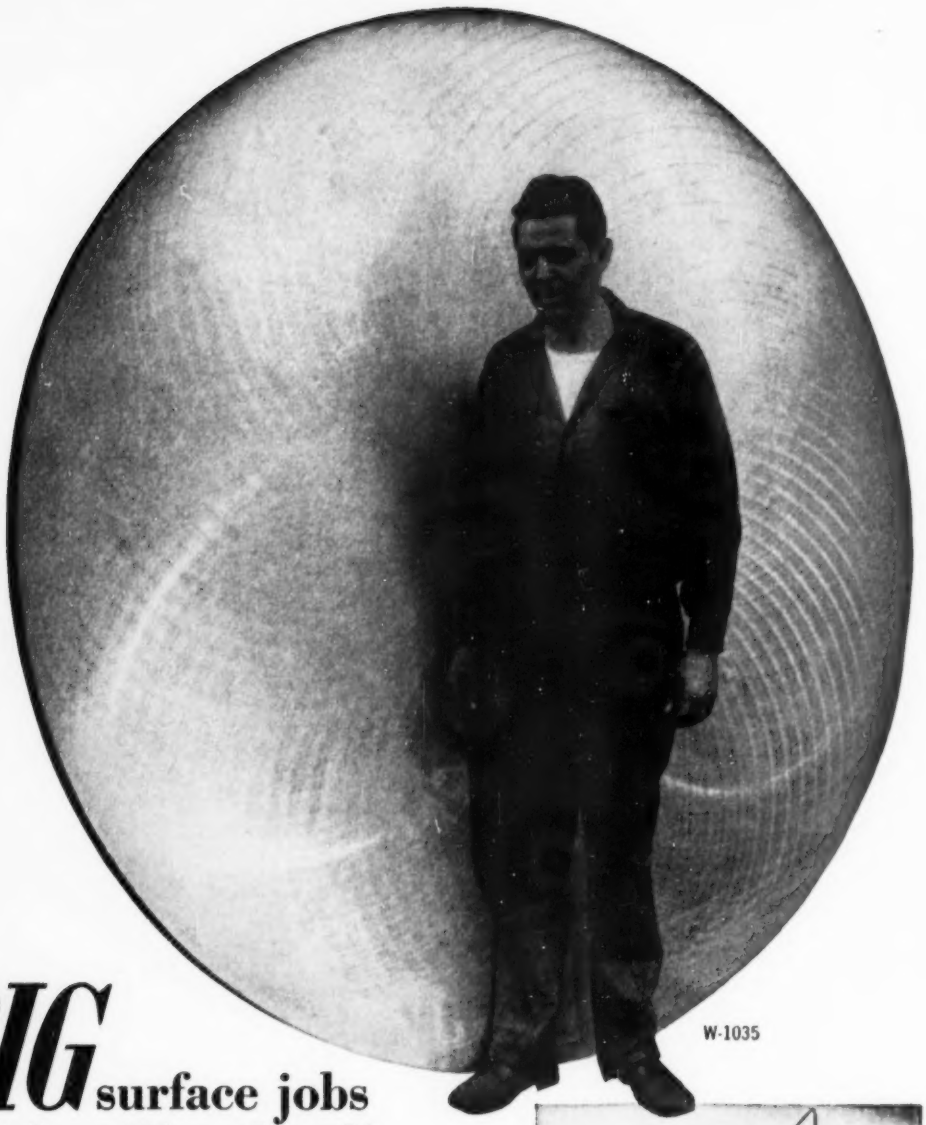
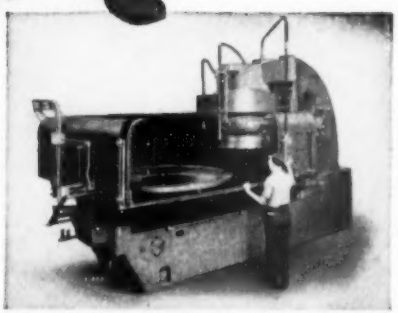


W-1035

Those *BIG* surface jobs are easy with a Blanchard!

No other machining method can match the speed, economy and quality of Blanchard Grinding on large flat surface work. This 88" diameter, cast iron plate, for example, was rough ground in 3½ hours, floor to floor. *¼" of stock was removed from one side —a total of 1520 cu. in.—380 pounds!*

After normalizing, finish grinding on the Blanchard produced a water-tight joint, with a Blanchard ground mating service, each being flat within .001". Why try to machine your large work with time-consuming methods, when Blanchard Grinding offers such speed, economy and quality with surprisingly low wheel costs?



NO. 42-72-84 BLANCHARD SURFACE GRINDERS

Send for your free copies of "Work Done on the Blanchard," fourth edition, and "Art of Blanchard Surface Grinding."

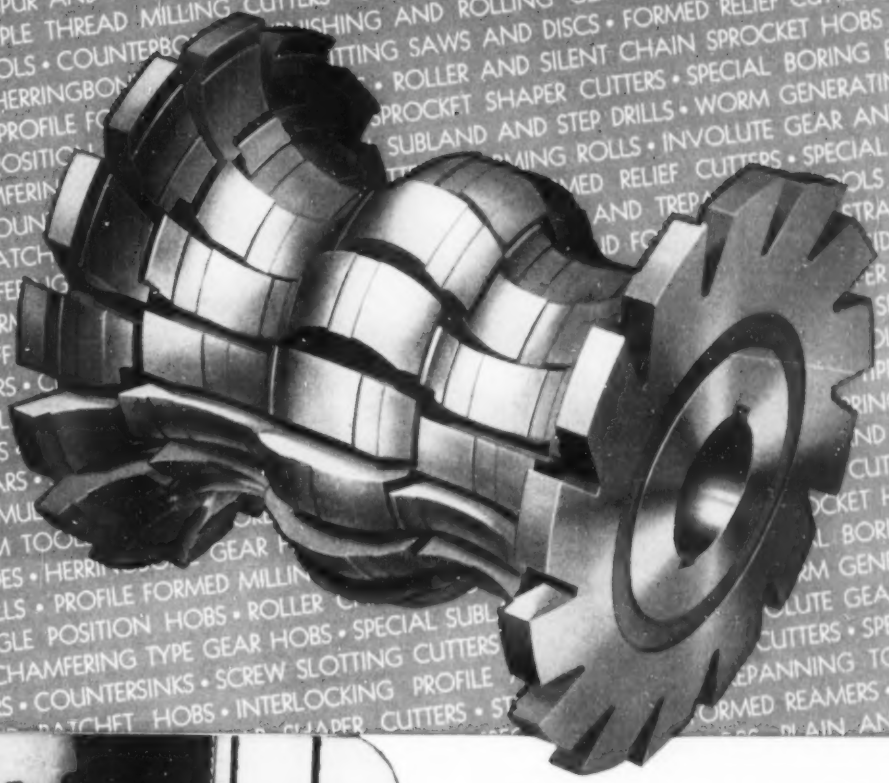
PUT IT ON THE **BLANCHARD**

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

FOR THOSE TOUGH *Special* JOBS

...DEPEND ON

National Tool Co.



● Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

Since 1905 engineers and manufacturers of high-quality special cutting tools for the metal-working industry

National Tools Cleveland

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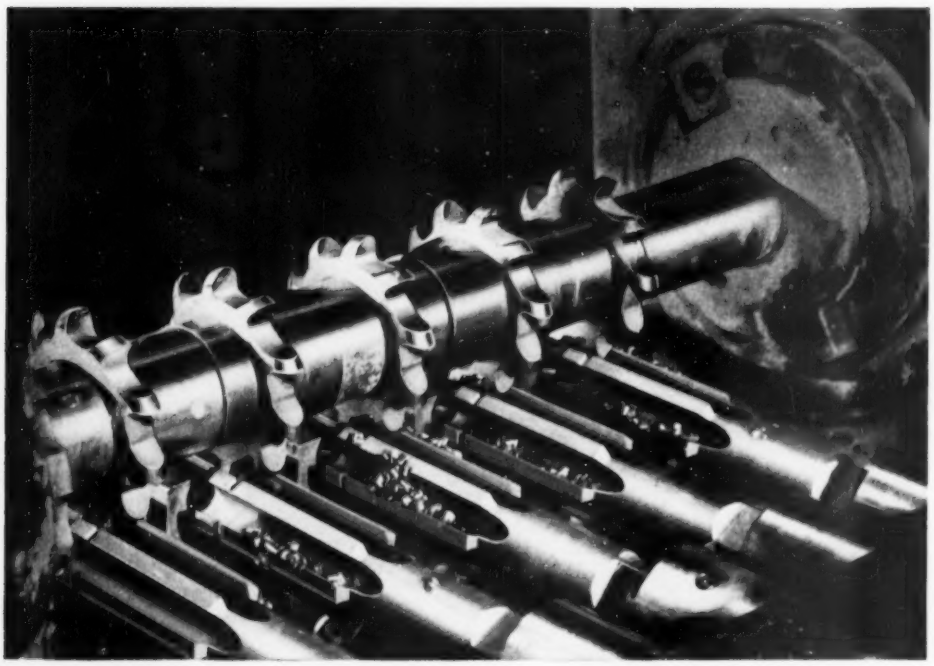
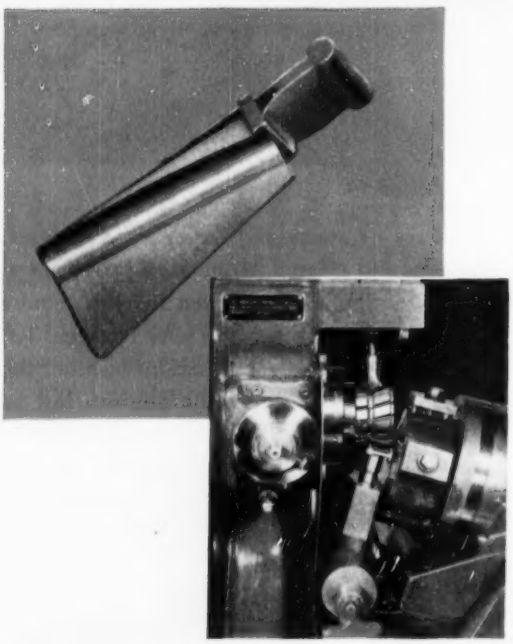
CUT FORM MILLING COSTS WITH





GET PEAK MILLING EFFICIENCY WITH SPECIAL FORM AND ACCURACY

Special milling problems become simplified when Barber-Colman Form-Relieved Milling Cutters are used on the job. Specialists in cutting-form development, Barber-Colman Cutter Engineers combine critical job features with maximum cutting efficiency in the cutter design.

Using special equipment and skills, forms are accurately developed and reproduced on cutter teeth to assure consistent duplication and accuracy in successive cuts. Cutters are projected 50 to 100 times size against engineering layouts to check exact tolerances. Accuracy of form is maintained the full length of the teeth and indexing of teeth is held to close tolerance, allowing the cutters to be sharpened accurately on automatic sharpening machines.

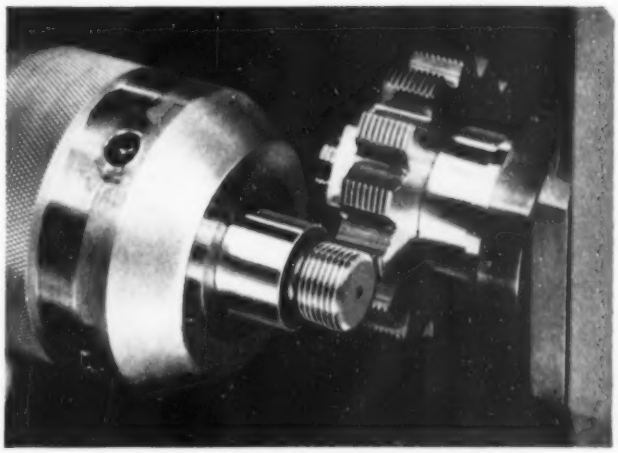
Many times, a series of cuts can be combined into a single combination-form cutter. As an example, several surfaces on these turbine blades are cut with a single cutter. The special cutter form controls accuracy, finish, and form automatically, making the job easier for the operator and reducing the cost per piece.

DESIGNERS OF STANDARD AND SPECIAL

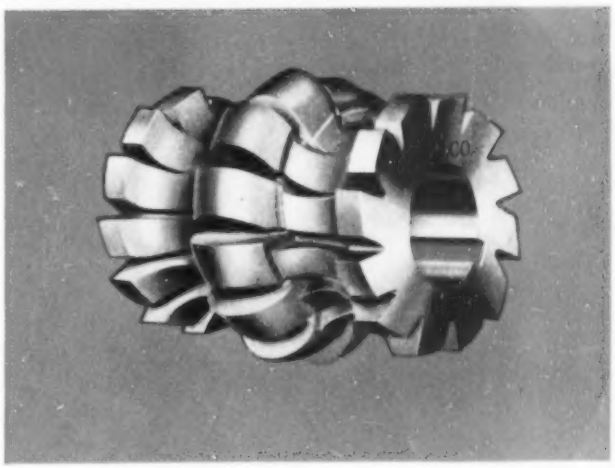
Barber-Colman FORMED CUTTERS

ACCURATE UNGROUND CUTTERS

New standards of production accuracy are available with unground form-relieved cutters because of special engineering techniques and heat treating methods. A change in tool design on this class 3 thread milling job, has cut tool costs and improved the set-up. Barber-Colman engineers designed unground shell type cutters with larger diameter and greater number of teeth to replace ground shank type cutters previously in use. The new design provides class 3 accuracy on 3/4"-16 threads and improves the cutting action with a rigid, short-coupled drive.



These Barber-Colman ganged formed cutters hold exact form limits on contour of 3 lobe supercharger rotors, maintaining high production and tool life. Form on each lobe is held within .003" at a radius of 1.160". Production is 30 minutes floor-to-floor per rotor, 50 rotors per sharpening.



These typical jobs are evidence that special form-relieved cutters can aid you on many of your complicated milling problems. Cutter efficiency of this type is possible with tools engineered-for-the-job. Try Barber-Colman form-relieved cutters on your next production milling problem and experience the satisfaction of having fewer operations, simplified tooling, faster production and trouble-free machining. Send us blue-prints and sample parts for analysis and quotation.

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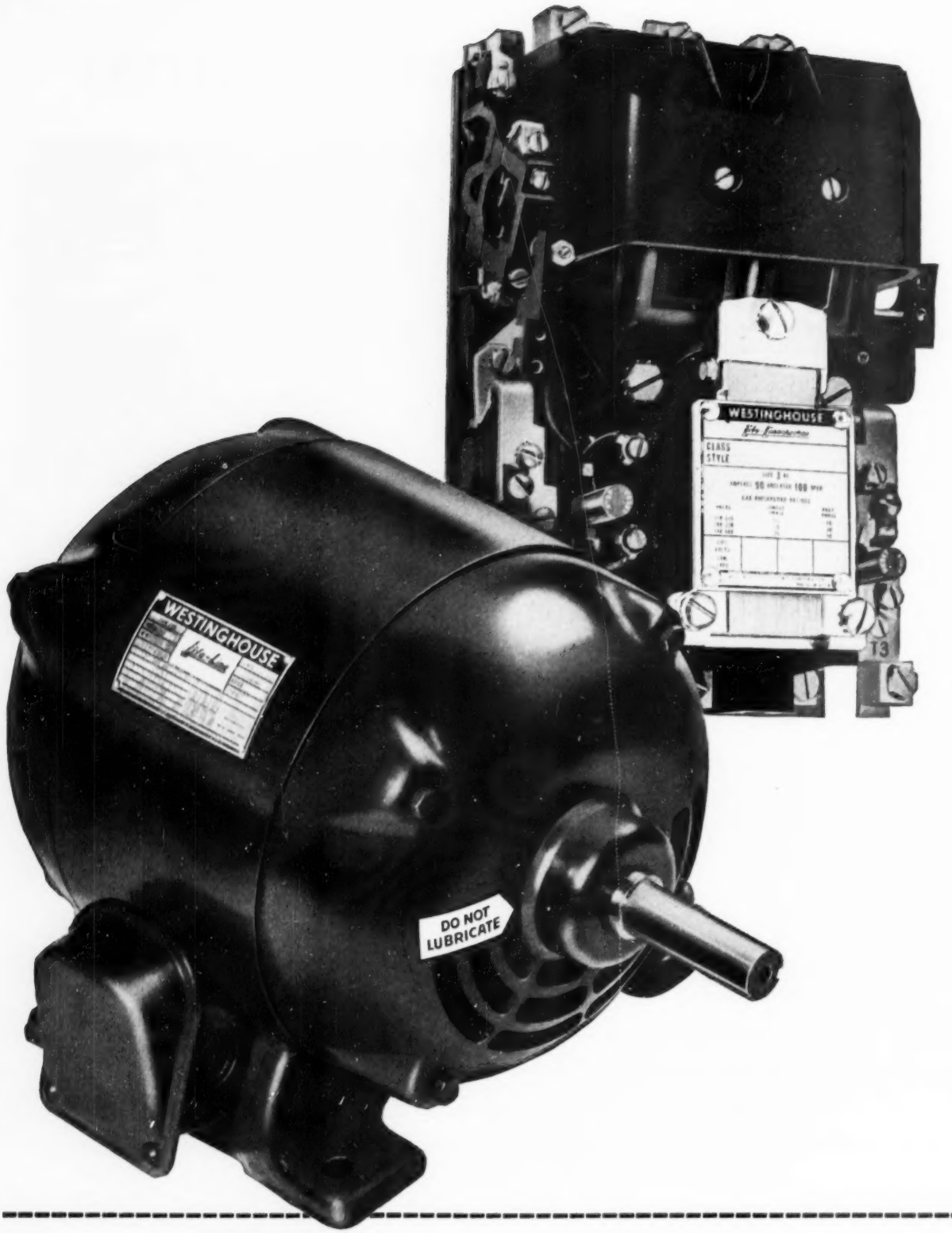
Barber-Colman Company

GENERAL OFFICES AND PLANT, 613 ROCK STREET, ROCKFORD, ILLINOIS, U.S.A.

METAL CUTTING TOOLS SINCE 1908



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See the space you save with these modern *Life-Lines*

Both Life-Line motor and Life-Linestarter are space stretchers. The reason? Compactness. They are smaller, lighter than most conventional types . . . can be installed in close quarters where others can't be accommodated.

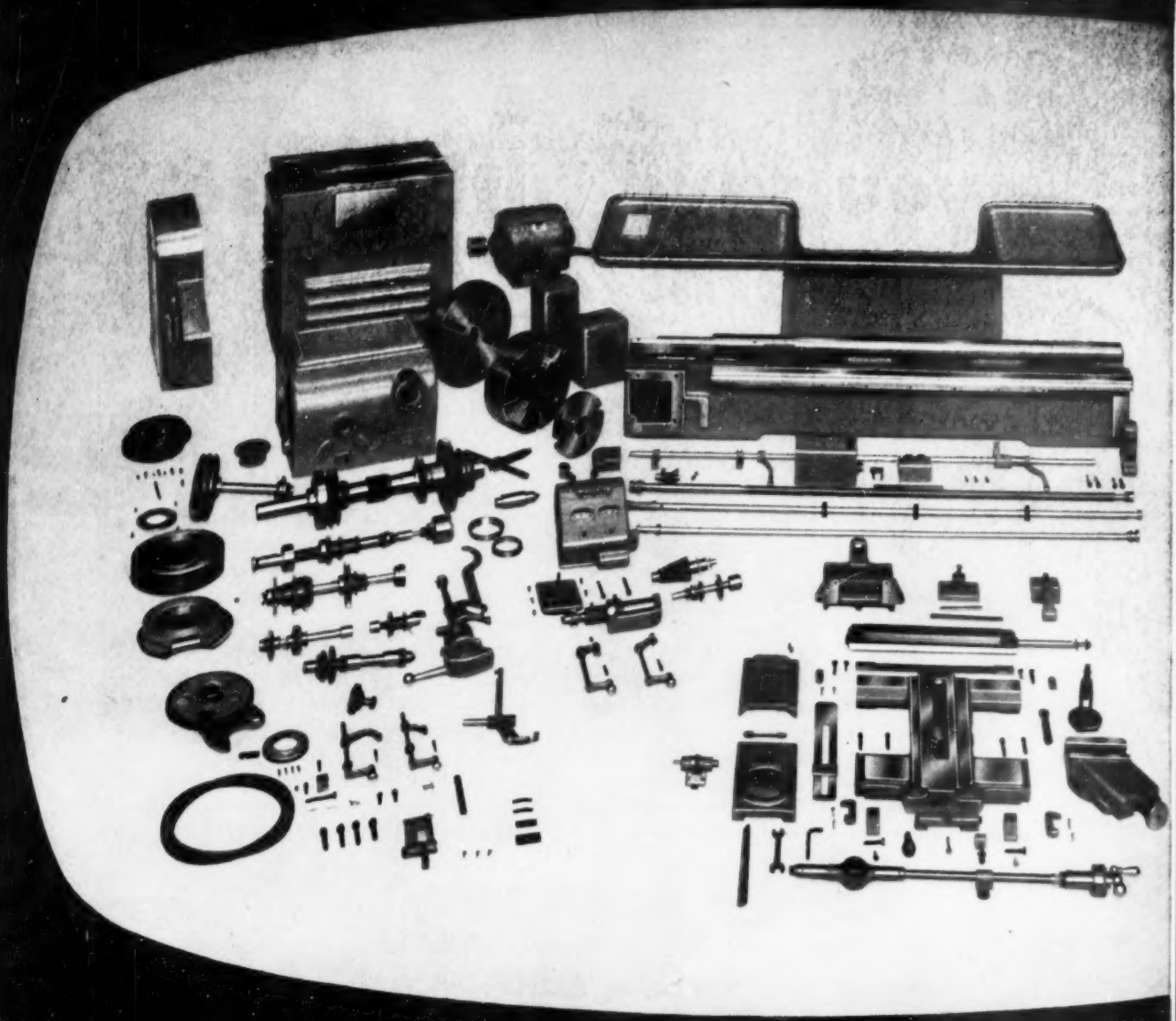
Notice that the motor has no grease cups or fittings. It's pre-lubricated . . . needs no further lubrication. This means you can cramp it into close quarters, forget greasing channels and nipples brought to outside of machine. Just install it in "hard-to-get-at" locations and forget it! The way to grease a modern motor is *don't*.

A check of the Life-Linestarter will show you all parts can be removed straight from the front. No need to allow extra work room for servicing. Further, wiring is straight through. You get simplified wiring, shorter leads. And you can have two electrical interlocks without increasing starter width. This means, smaller cavities and more compact cabinets.

These features give you the most advanced designed equipment available today. Built to match the modern advancements you build into your equipment. But get complete data. Ask your Westinghouse representative for latest information, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21692-A

YOU CAN BE SURE...IF IT'S Westinghouse

see what makes the



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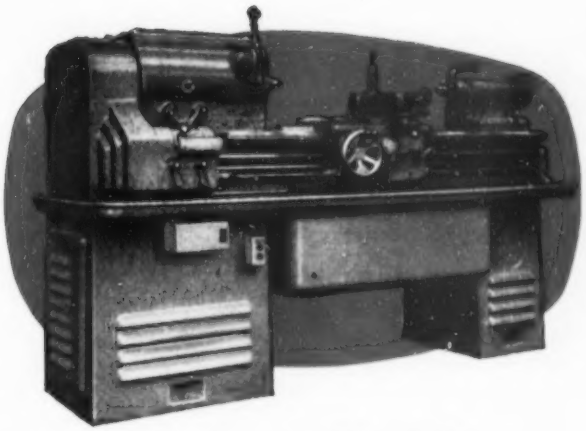
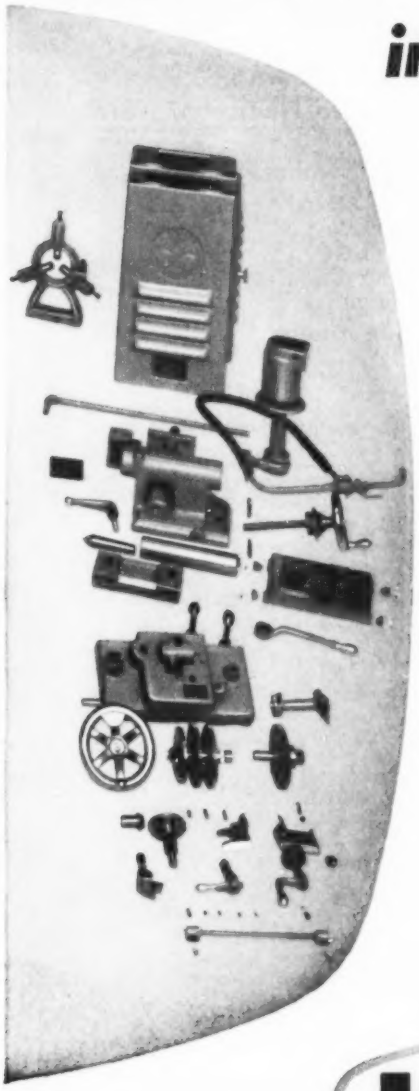
your best buy in the medium-price field





compare—
part by part, feature by feature...

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Dual Drive's headstock design combines belt and gear drive to give you the widest range of speeds in its class—*all at full horsepower.* Twelve speeds from 28 to 1800 rpm.

OPTIMUM SIZE

15″ swing to take care of virtually all of your medium-duty turning. 30″ base center distance; more in increments of 12″.

BIG FEED-THREAD RANGE

Ninety-six feeds from .0004″ to .106″.
Forty-eight threads from 4 to 224.

CONVENIENCE

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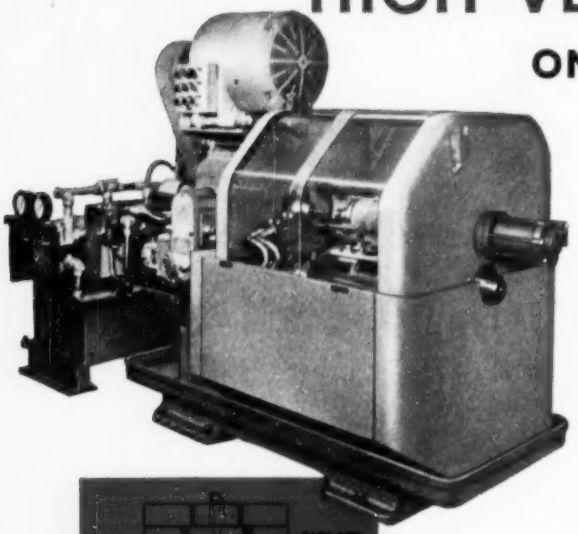
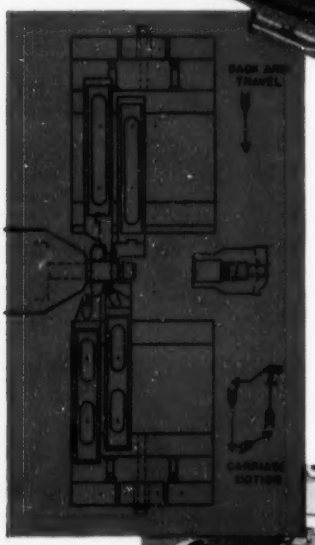


SIDE GEARS
18 Seconds Floor to Floor — 635 SFM

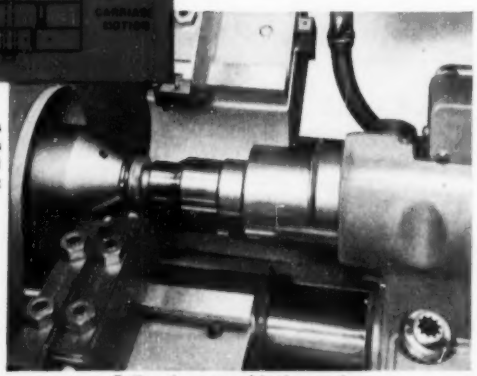
Two 8" Fays, with Automatic Sequential Control, machine all exterior surfaces of the blanks in two operations; one machine for each. The major diameter is 2-15/16" and floor to floor time is approximately 18 seconds in each operation.



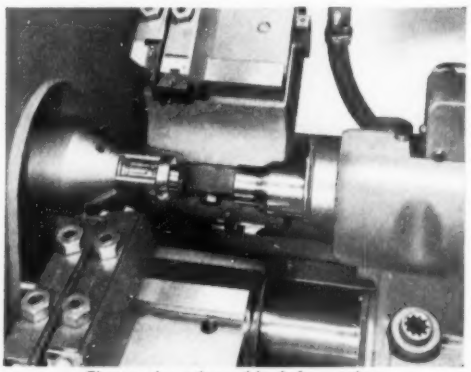
Automatic Cycle—The machines are equipped with automatically operated splash guards and automatically air-operated tailstock rams for pressing the blank onto a splined arbor equipped with automatically operated ejector pins.

The operator places the blank on the end of the arbor, and pushes the cycle start button. *Automatically, the guard closes, the tailstock ram presses the piece onto the arbor and then retracts. The carriage turns, the back arm faces, and at the end of the cuts, ejector pins push the piece onto the loading section of the arbor* from which it is removed manually.

FIRST OPERATION: Note intricate movements of the carriage, which turns the hub, back angle and major diameter. The back arm faces and forms.



Tailstock presses blank on arbor



Ejector pins release blank from arbor

Production management regularly relies upon the engineering services of Jones & Lamson for the latest information on methods, costs, tooling and performance. Why not consult us about YOUR *turning, threading and inspection problems.*

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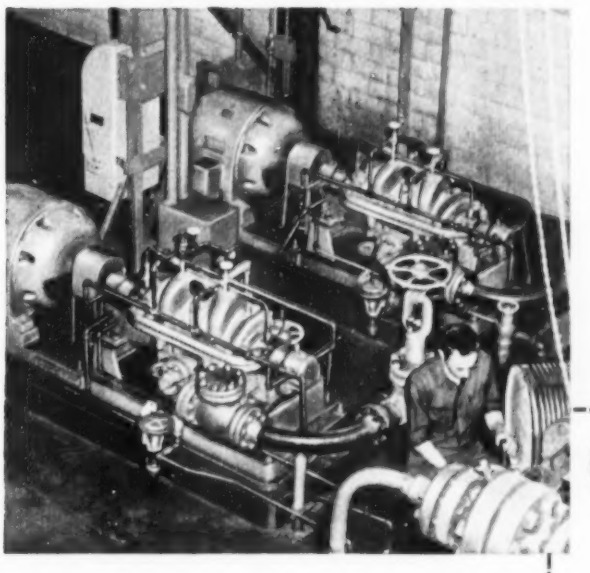

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*Oxygen pitting was destroying the high pressure water pumps in General Electric's Coshocton, Ohio, laminated plastics plant. Rod packing had to be replaced every three days. Pure Oil's sales representative suggested adding PUROSOL No. 10 to the water. Result: damage stopped—and a saving of $4,000 a year.

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- **SIMPLE LOADING**
- **AUTOMATIC CLAMPING**

the *American* WAY

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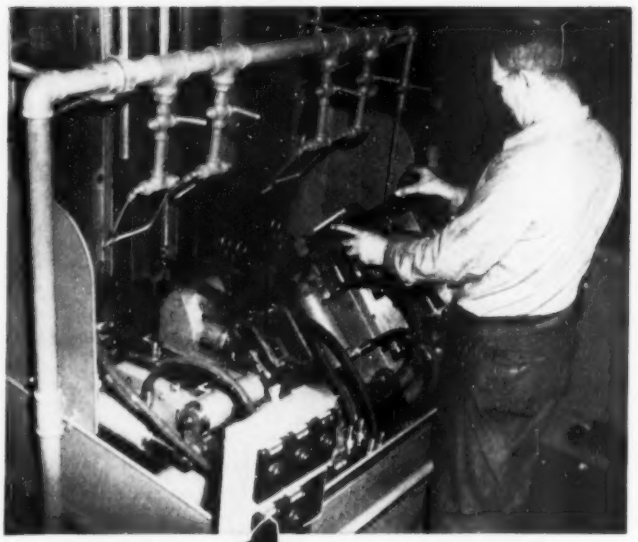

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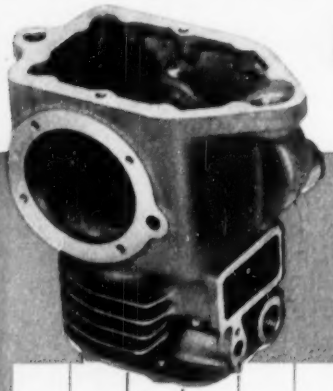
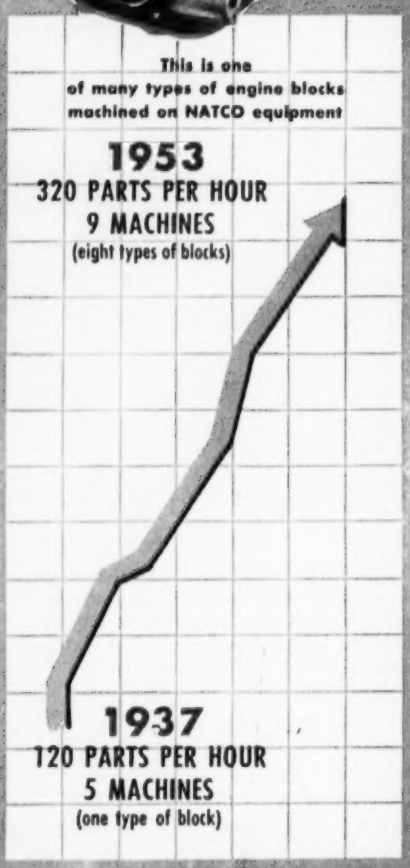
well known manufacturer produces record MILLION ENGINES in 1952

9 NATCO machines produce all holes in 320 engine blocks per hour



This is one of many types of engine blocks machined on NATCO equipment



Here are the facts...

Back in 1937 a well known engine manufacturer installed four large NATCO Station Machines and a tapper. These machines performed a total of 170 operations on 120 engine blocks each hour. Modifications increased production to 140 blocks per hour on any of eight types of engines.

In 1951 this engine manufacturer added four new NATCO Station Machines to their production lines. These new machines performed the same operations on 180 engine blocks per hour on any of eight different blocks.

Here again is another example of a NATCO engineered production installation proving successful and additional equipment being added to further increase production and to lower costs.

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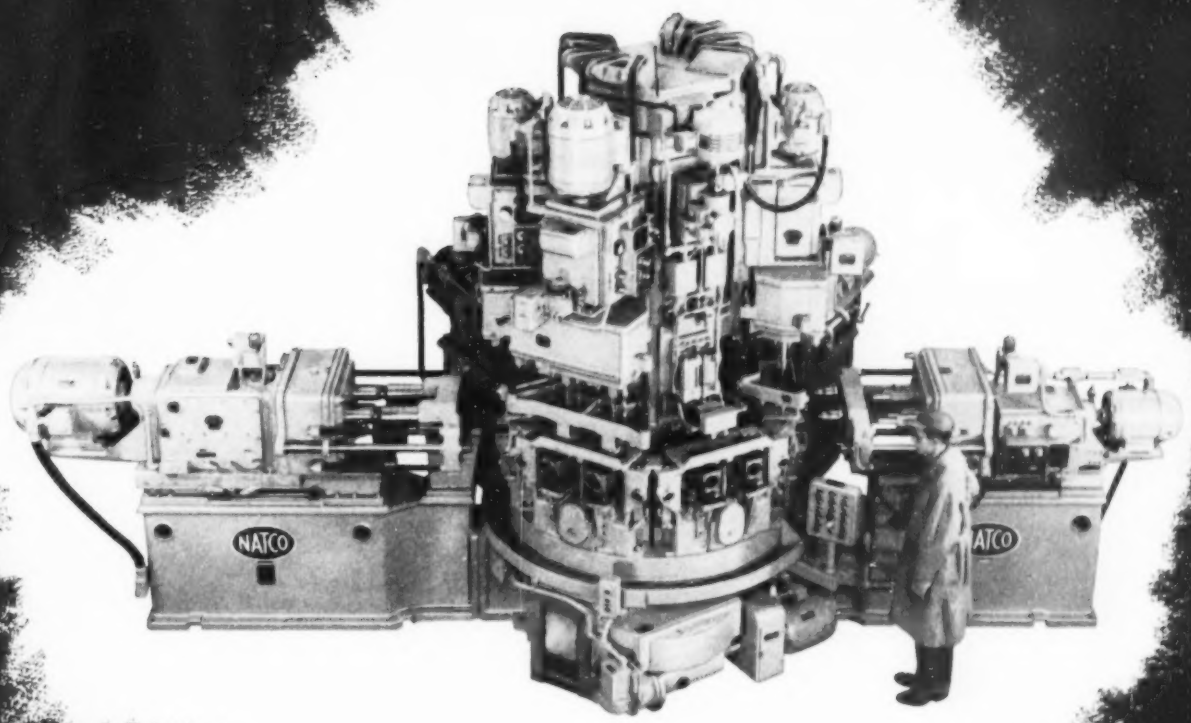
NATCO ENGINEERED
for quality and quantity production



One of 9 similar NATCO Station-type Machines helping to make this production record possible.

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

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when the call comes for a change in shape, size or material . . . machines equipped with

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These conditions place a premium on machines with top "changeover capacity" . . . machines that can be shifted quickly and economically from job to job—from one shape, size or material to another.

That's what REEVES Variable Speed Drives can do for the machines you build. Give them *extra* "changeover capacity" by providing the right speed—with the turn of a handwheel, touch of a button, or automatically, without stopping the machine—for each different product or material.

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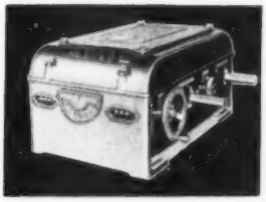
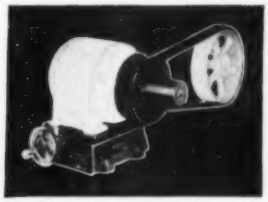
Recognized leader in the specialized field of speed control engineering

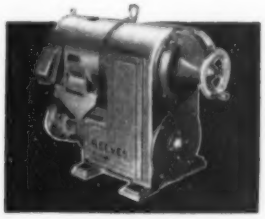
for the machines you build, your choice of these three basic REEVES units



VARIABLE SPEED TRANSMISSION provides infinite, accurate, stepless speed adjustability over a wide range—as high as 16 to 1. Sizes to 87 hp.

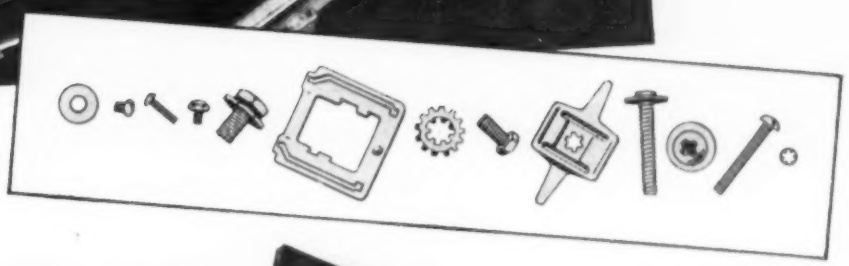


VARI-SPEED MOTOR PULLEY converts any standard, constant-speed motor to variable speed drive. Speed variations to 4 to 1. Sizes to 10 hp.



VARI-SPEED MOTODRIVE combines motor, speed-changing mechanism and gear reducer in one unit. Speed variations as great as 10 to 1. Sizes to 25 hp.

A REEVES Vari-Speed Motor Pulley drives the conveyor to provide accurate time control for each of these six continuous draw furnaces installed in the Elgin (Ill.) plant of Shakeproof Inc.—a Division of Illinois Tool Works. Manufactured by Sunbeam Stewart Industrial Furnace Div., Sunbeam Corp., Chicago, the REEVES-equipped units provide close control in order to assure proper heat treatment, at highest production rate, for each of the many metal fastenings processed, some of which are shown in the inset photo, below.

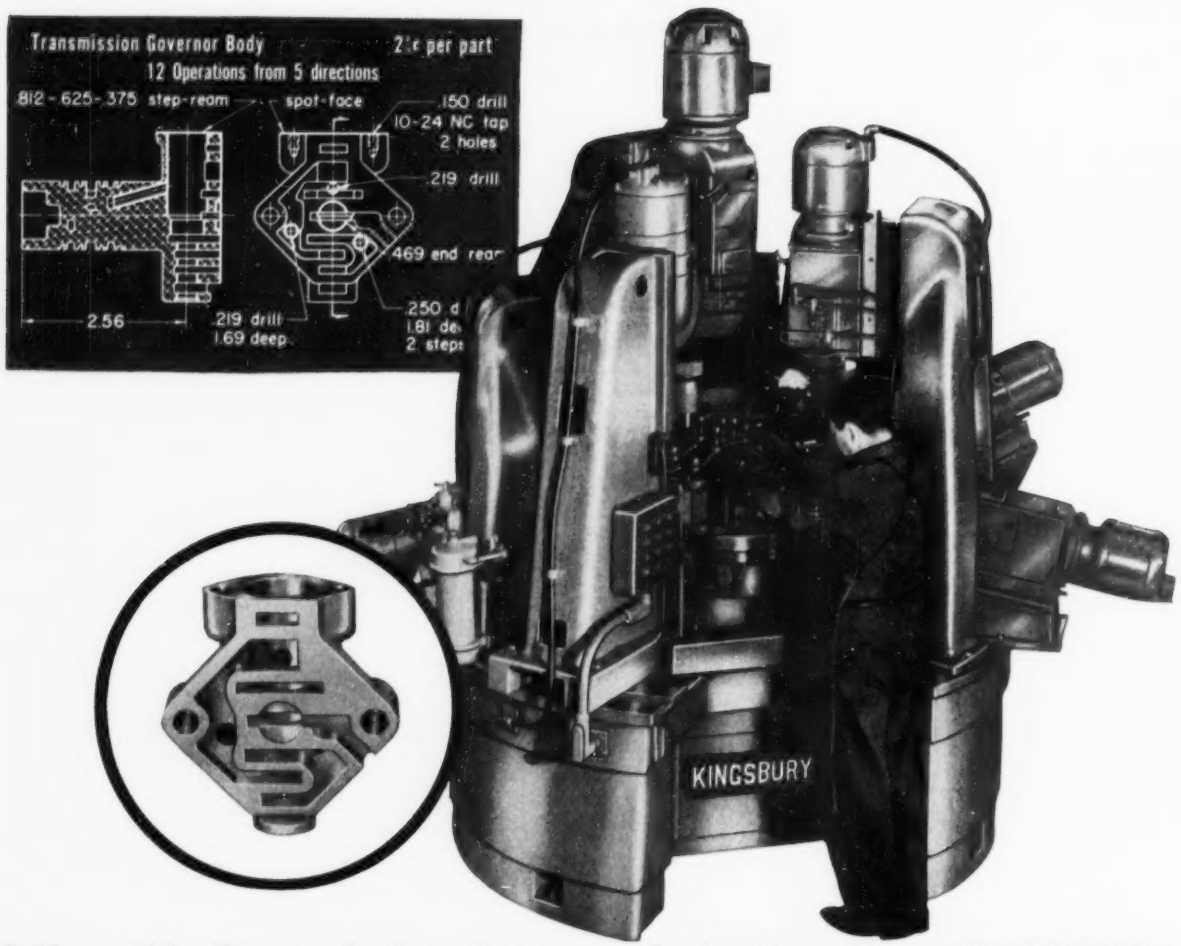


accurate · variable

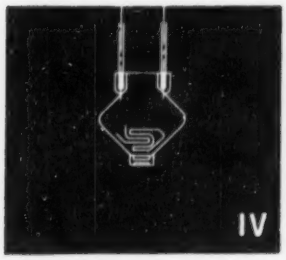
REEVES *Speed Control*

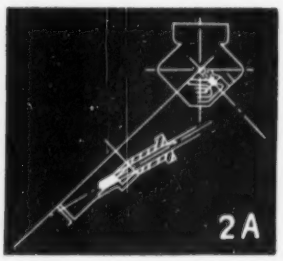
Ask for complete information, including engineering drawings and technical data, on the full line of REEVES Variable Speed Drives and Controls. Send for catalog No. A73a-3N.

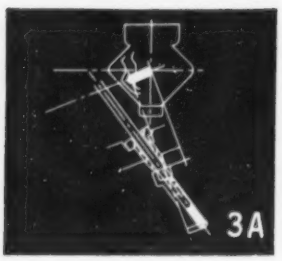
Every few seconds your Kingsbury will

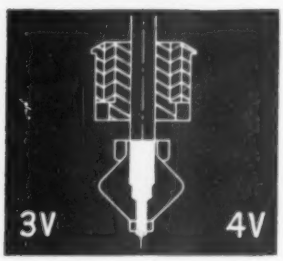


Follow this Transmission Governor Body through a KINGSBURY









Designing a Kingsbury to drill, ream, tap and spot-face this die cast aluminum Transmission Governor Body presented some interesting problems. Units at six stations perform 12 operations from five directions and produce 360 parts per hour gross. There are four vertical (V) units, four angle (A) units, and one horizontal (H) unit. Let's follow the part in its cycle through the machine.

At Station 1, Unit 1-V drills two .150 holes.

Station 2 has two units. Unit 2-A spot drills .250 hole .500 deep at an angle of 10° uphill and 9° right of center line through the work fixture. Note the guide bushing. Unit 2-V (not sketched) operates a 1.750 spot-facing tool.

Stations 3 and 4: Unit 3-A drills .219 hole 1.69 deep at an angle of 6° uphill and 15° left of the center line through the work fixture. Unit 3-V (the tallest) has a 2-spindle auxiliary head with one spindle operating at Station 3 and the other at Station 4. Jergens rotary bearings guide these tools. Spindle 3-V end-reams a hole .782-.595-.331. Spindle 4-V finish-reams the hole .812-.625 .375. At Station 4, Unit 4-H operates a .469 end-cut reamer .11 deep.

The operation at *Station 5* is something special. It was interesting to

deliver another finished part—at low cost

Kingsbury Machine Tools soon pay for themselves in high production runs

Each Kingsbury is designed and built to perform certain operations accurately and automatically. Work fixtures on an index table hold the parts and present them to the various operating units in turn. These units of ½ to 5 hp drill, ream, c'bore, mill, tap, thread, etc.

These combined operations cut unit costs in several ways:

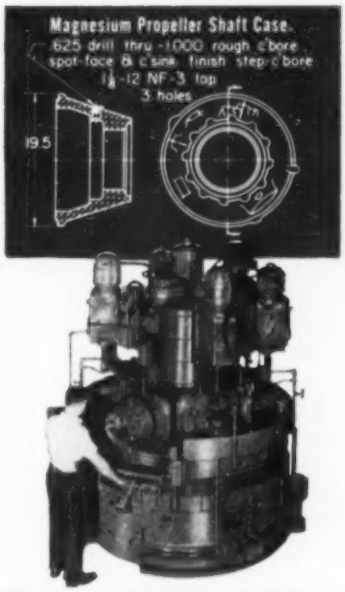
1. Increased production per man-hour.
2. Almost no scrap loss. Each part is machined uniformly to specifications.
3. Less floor space than required for separate machines.
4. Less handling of parts.

This is only part of the story. Do you want the rest?

Kingsbury Machine Tool Corp.
100 Laurel St., Keene, N. H.

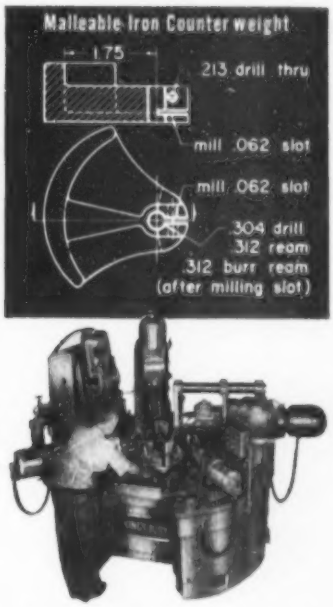
KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production



Magnesium Propeller Shaft Case
90 parts per hour gross
13 9/10¢ per part

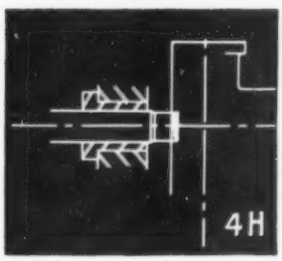
Here is an unusual application of a Kingsbury with central column. Five vertical units perform the same five operations on three holes in three passes around the machine. Each part is chucked in three fixtures, one at a time, to locate it for the three holes. This rechucking saves two machines.

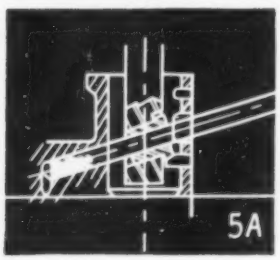


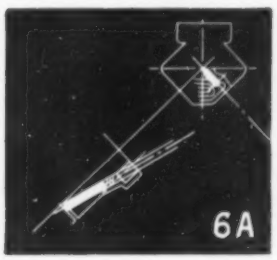
Counterweight—3¢ per part
200 parts per hour gross

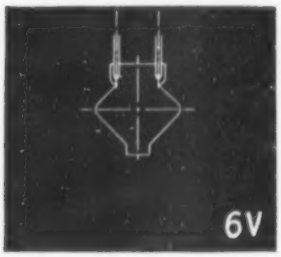
This Kingsbury performs six operations from two directions. It drills two holes, mills two slots, and reams the two holes. Parts are clamped in seven fixtures on a 20-inch dia. index table; two vertical and four horizontal units perform the operations at six working stations.

as it produces 360 parts per hour gross—at 2 4/10¢ each









work out, and naturally we are proud of the result. The job required a .219 hole starting from the inside of the .812 reamed hole. It was necessary to introduce a guide bushing into this larger hole.

You can't see it in the photograph, but there is a lever controlled by the outside path of the regular feed cam that actuates a vertical ram mounted on the column. This ram holds a guide bushing which is moved directly downward into the .812 hole in the work. As soon as it is in place, the .219 drill drills the angular hole.

Station 6 has two units. Unit 6-A completes the drilling of the .250 hole started at Station 2-A. Unit 6-V with two 10-24 NC taps, performs the tapping operation in the two holes drilled by Unit 1-V.

The work fixture is unclamped automatically as the table indexes to the unloading station.

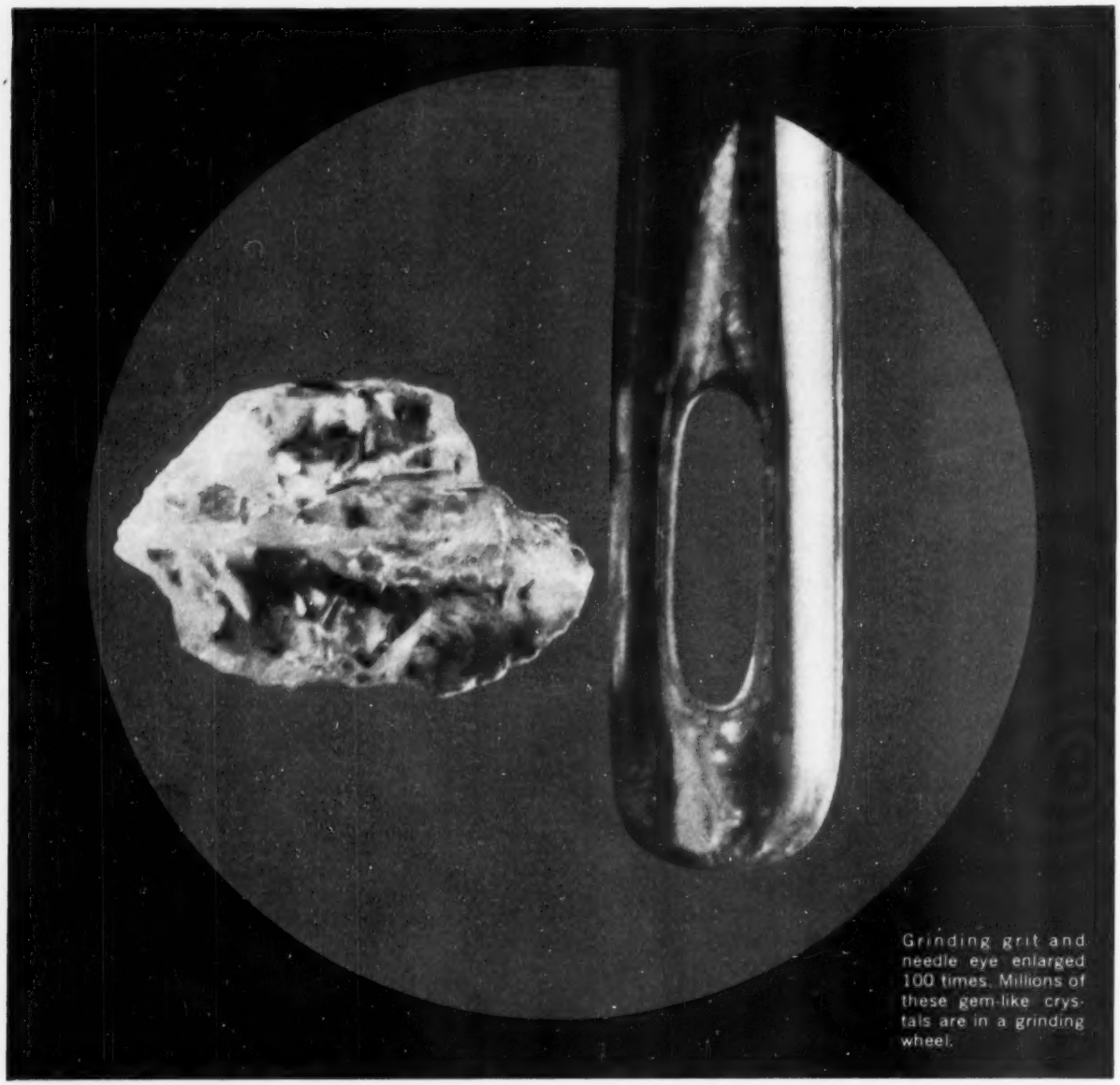
Each Unit Cost on the drawings includes the cost of the man and of the machine — no power or overhead. We assumed:

Unit cost of man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross x 80\% efficiency}}$$

Unit cost of machine to be:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hrs. @ 80\% efficiency}}$$



Grinding grit and needle eye enlarged 100 times. Millions of these gem-like crystals are in a grinding wheel.

GRINDING GRIT IS START OF NEW CONCEPT THAT LED TO CINCINNATI GRINDING WHEELS

Sometimes looks deceive. A tiny grinding grit like the one above does not look like a cutting tool. It has no recognizable clearance or rake angles . . . no cutting edge is apparent . . . it cannot be accurately shaped . . . and it is very fragile.

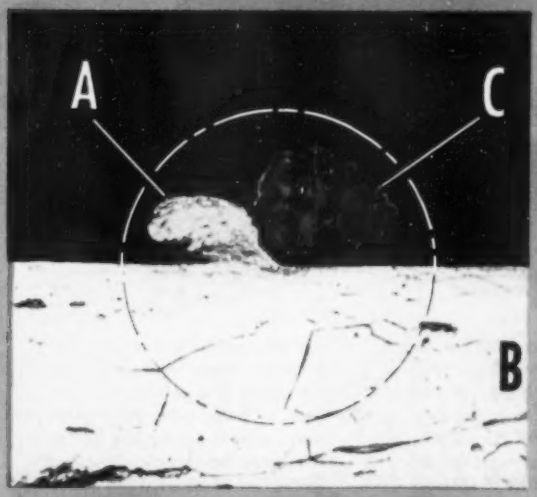
Nevertheless, the grinding grit is a true cutting tool that functions in virtually the same manner as a tooth of a milling cutter.

Research discoveries by Cincinnati Milling proved, beyond doubt, that the grinding process is a true metal cutting process. The grinding grits do not abrade or wear away the surface of a workpiece but form chips which agree in classification with the basic chip types found in other metal cutting processes.

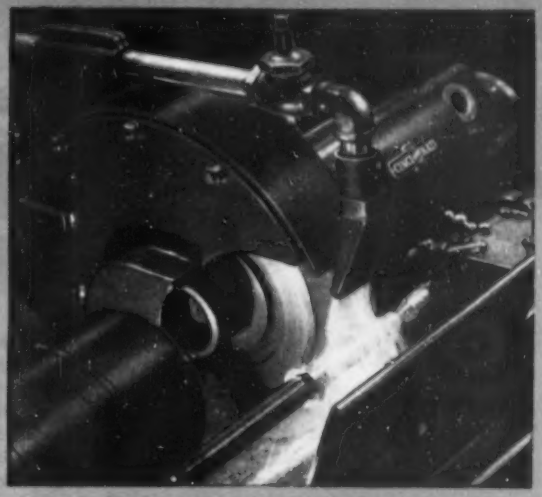
This entirely new approach is not based on hasty conclusions. It represents 25 years of Cincinnati Milling research, coupled with practical experience in applying the basic fundamentals of grinding to a wide variety of work on both centerless and centertype machines.

For you, this means grinding wheels developed and tested over a period of several years on the basis of true function—as true cutting tools forming true chips.

Available to you is a field organization of trained machinists who know grinding and grinding machines as well as grinding wheels. For a demonstration on your own machines of how to get the most out of Cincinnati Grinding Wheels, write, wire or phone Cincinnati Milling Products Division, The Cincinnati Milling Machine Co.



Frozen Action—Tiny steel chip (A) is shown being cut from workpiece (B) by a grinding grit (C).

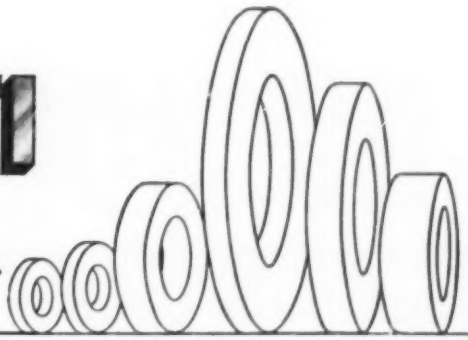


RESEARCH GRINDING problems have ranged from the grinding of surgical sutures .004" in diameter to steel mill rolls 60" in diameter.

Front of the new, completely modern Cincinnati Milling plant where Cincinnati Grinding Wheels are manufactured.

FREE BOOKLET. Now available to industry is a new booklet entitled "A New Concept In Grinding wheels." It contains valuable information for everyone interested in grinding operations. A copy is yours for the asking. Just write Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



LONG LIFE!

1

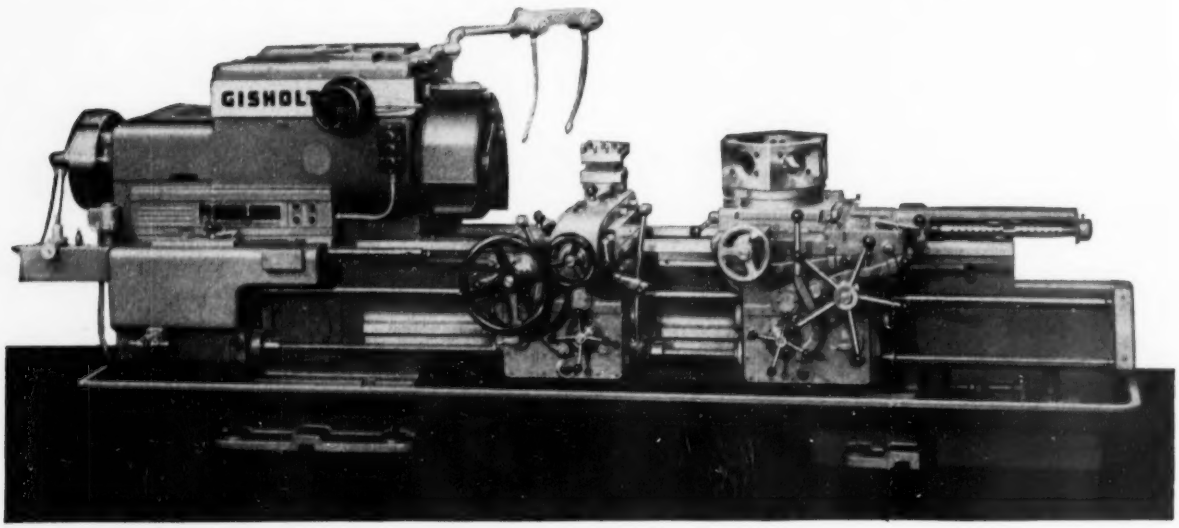
All gears in Gisholt turret lathe transmissions are high carbon alloy steel, precision ground after heat-treatment to assure long wearing quality. All shafts turn on antifriction bearings, with pressure spray lubrication. Headstock is cast integral with bed for extreme rigidity—to maintain accurate, permanent alignment.

2

Gisholt's thick, block-type ways are automatically pressure lubricated. Made of SAE 52100 tool steel, they are deep hardened to 64-66 Rockwell C and then finish-ground for exact alignment with the spindle. On top, bottom and both sides, they present a bearing surface that is virtually wear-proof—accurate for years to come.

3

Aprons are fully enclosed, all working parts protected and operating in a continuous cascade oil bath. Alloy steel gears and shafts are mounted on antifriction bearings. Positive serrated feed and traverse clutches cannot slip or drag. Safety shear pins protect feed and traverse mechanism against overload and accident.



You'll find all the speed and easy operation you want in these new Gisholts. But you want long life, too. Here's the lasting accuracy, freedom from repair bills and proved performance that protect your turret lathe investment for years to come.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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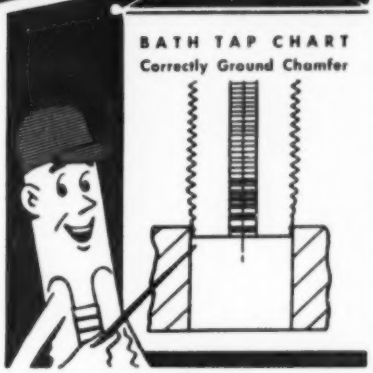
TAP-ODDITIES



At work — the taps with chatter marks,
Pete doesn't give a damfer.
He always specifies Bath Taps
For a smooth, clean-cutting chamfer!

At home — Pete cannot quite control
Dull "chatter" by his Wife.
The "waste material" she picks up
Is shortening poor Pete's life!

An important phase of Bath tap manufacture is chamfering — or, the grinding of the tapered outside diameter at the front end or point. The grinding is smooth when cutting away the crests of the first few threads — you'll find no chatter marks to pick up material or load. All Bath Taps are carefully checked at the plant for length of chamfer or number of threads specified.

Taps will dull with everyday use — and it is well to keep these things in mind:

Is the chamfer sharp?

Is the chamfer the right length?

Is the point diameter right for the size hole to be tapped?

Only one thread should enter to get full benefit of the chamfer. Too small a diameter throws the burden of cutting on a few threads in the chamfered section. Result — a harder working tap, higher tap breakage and bad threads.

Start the job right — insist on Bath ground from the solid Taps and Gages — they're made for precision and long wear.

INSIST ON BATH TAPS
— PROFIT BY THEIR
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PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

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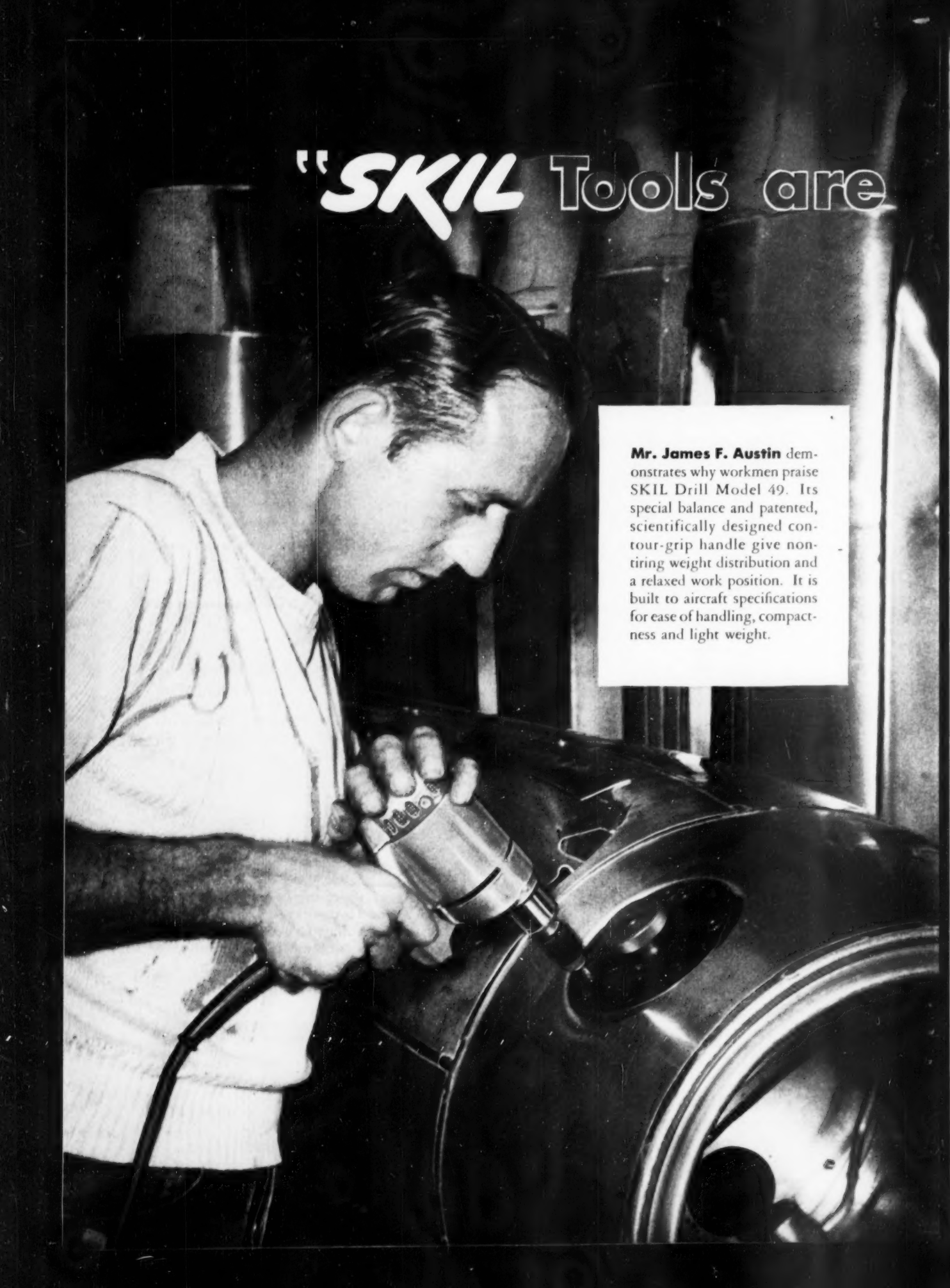

Mr. James F. Austin demonstrates why workmen praise SKIL Drill Model 49. Its special balance and patented, scientifically designed contour-grip handle give non-tiring weight distribution and a relaxed work position. It is built to aircraft specifications for ease of handling, compactness and light weight.

one secret of our record production"

"More than 130 SKIL Drills Have Helped Keep Smooth Production"

says **Mr. Martin Konoske,**
Production Superintendent
Fletcher Aviation Corporation,
Pasadena, California

"The most important single item here at Fletcher Aviation Corporation is meeting production schedules. We make good tanks and we're proud of them, but equally important is the 'on time' delivery stamp at the conclusion of our contracts," says Martin Konoske.

"In meeting these 'on time' deliveries, SKIL tools perform a very necessary function along our production line. We have standardized on SKIL portable drills," added Mr. Konoske. "More than 130 Model 49 SKIL Drills have helped greatly to keep our production lines running smoothly and aided us in producing more external fuel and napalm tanks for the Air Force than any other manufacturer. This pace-setting performance is the result of careful design planning, advanced tooling and a smooth-running production line."

Workman James F. Austin (see opposite page) explains this choice. He says, "Power, durability and handling ease . . . that's what sold me on SKIL Drills."

Learn more about what SKIL can do to speed production and cut costs for you. Contact your SKIL Distributor for help in selecting suitable SKIL Tools or phone or write the nearest SKIL Factory Branch.

Three SKIL Drills "gang up" to speed another step in assembly of airplane wing tanks.

SKIL
PORTABLE TOOLS

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formerly SKILSAW, Inc.
5033 Elston Ave., Chicago 30, Ill.
Factory Branches in 34 Principal Cities

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for those who need a
LIGHT-HEAVYWEIGHT
Machine

—that's the WALKER-TURNER line

For jobs where neither the capacity nor expense of a heavy industrial machine is warranted, and where a "hobby machine" would be wholly inadequate, Walker-Turner has engineered a special class of light-heavyweight power tools.

Professional in design and operation, yet light for production machines, the Walker-Turner "in-between" line gives industry the capacity needed for short-run production work, without the necessity of heavy investment. For complete information, write your name and address in the margin below.

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KEARNEY AND TRECKER CORPORATION
PLAINFIELD, N. J.

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NEWEST LIGHT-HEAVYWEIGHT 15″ WALKER-TURNER DRILL PRESS WITH 6″ SPINDLE TRAVEL

Designed for fast, accurate drilling at new low levels of investment and production costs. Features calibrated depth indicator. Capacity: Bench Models — 12″ chuck to table, 17½″ chuck to base. 10″ x 12½″ table. Six spline spindle mounted on 2 ball bearings. 4 speeds — 600, 1250, 2440 and 5000 r.p.m. with 1750 r.p.m. motor. Available in bench, floor and multi-spindle models.

. . . . *Use this space* . . . . .

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Dept. AM-3, Plainfield, N. J.
(Please write your name and address in margin of page)

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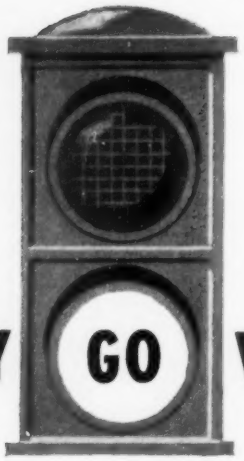
One of the major factors contributing to long tool life and better stamping is the working alignment of tools. This fundamental principle was recognized in the first V & O press. For more than 60 years the V & O long slide design has been preferred when tooling is costly.

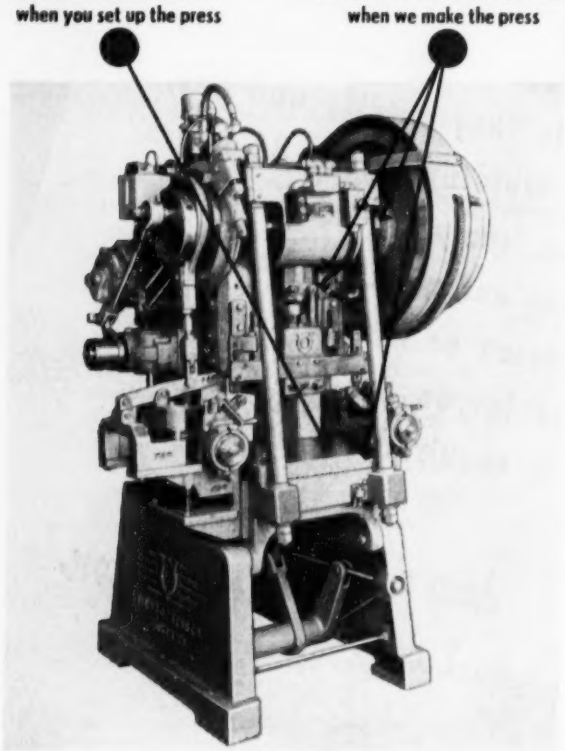


WHEN TOOLING IS COSTLY GO V&O

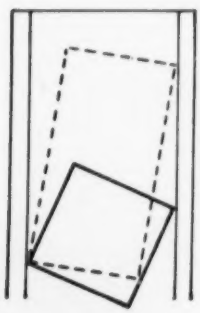
WORKING ALIGNMENT DEPENDS ON

WHAT YOU DO HERE
when you set up the press

AND WHAT WE DO HERE
when we make the press



More room to attach tools, controls, moving members, too



WHY THE V & O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide, the less possibility for angular misalignment.

WORKING ALIGNMENT depends upon properly aligned tools *STAYING* aligned throughout the power stroke. Simple geometry will show that the long slides on V & O Presses minimize the possibilities of the tools being forced out of line. The superior workmanship and accuracy of V & O Presses supplement this long slide principle. This is especially important on long strokes. The longer the stroke the greater the superiority of the V & O long slide principle.

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Division of Emhart Mfg. Co.

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HUDSON NEW YORK

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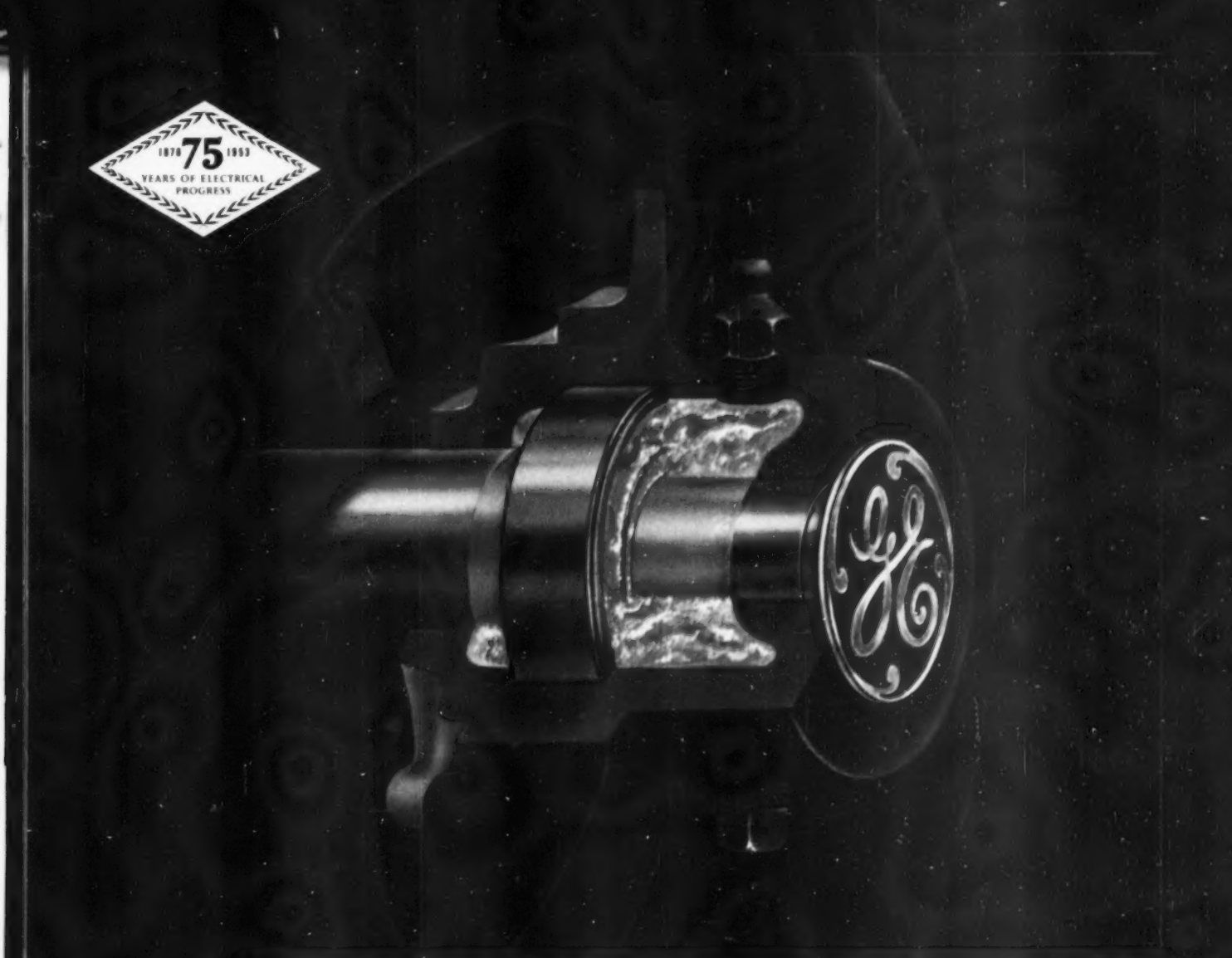
YEARS OF ELECTRICAL PROGRESS



These bearings last longer than life . . . grease life

G-E *TRI CLAD* MOTORS LAST LONGER

ALL GREASE LIFE IS LIMITED. The best known greases dry out in time. This may be six months, seven years, or longer, depending on motor application.

SOME MOTORS ARE USELESS WHEN GREASE DRIES OUT. They can't be regreased, you lose production time . . . because your maintenance man is "sealed out."

BUT GREASE LIFE NEED NOT LIMIT MOTOR LIFE. Tri-Clad motors give long life without relubrication, plus provision for adding new grease when necessary.

ADDED GREASE IS USEFUL GREASE. Relubrication puts fresh grease in storage in bearing housing . . . as motor operates, grease oils migrate to bearing as needed.

TRI-CLAD MOTOR BEARING IS EASIEST TO REGREASE. Do it on the job, with motor running . . . no dismantling . . . no trip to a service shop.

TRI-CLAD MOTOR BEARING IS BETTER PROTECTED. Completely enclosed housing has *longer seals* to keep dirt out, *larger grease supply*, and *scientific design* for continual grease migration.

THIS PRACTICAL BEARING DESIGN is one more reason why G-E Tri-Clad motors give better service . . . added life. Order through your nearby G-E Apparatus Sales Office or authorized G-E agent or distributor. General Electric Company, Schenectady 5, N. Y.

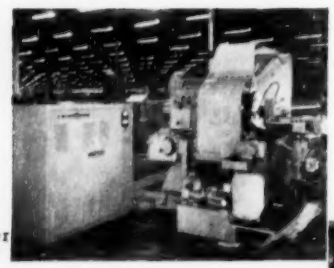
752-18

You can put your confidence in—

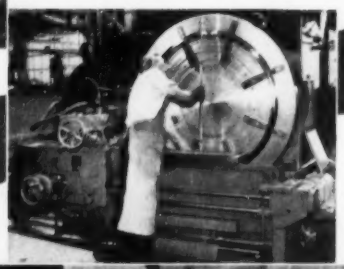
GENERAL ELECTRIC

Jet Builders Report on *T* Lathes*

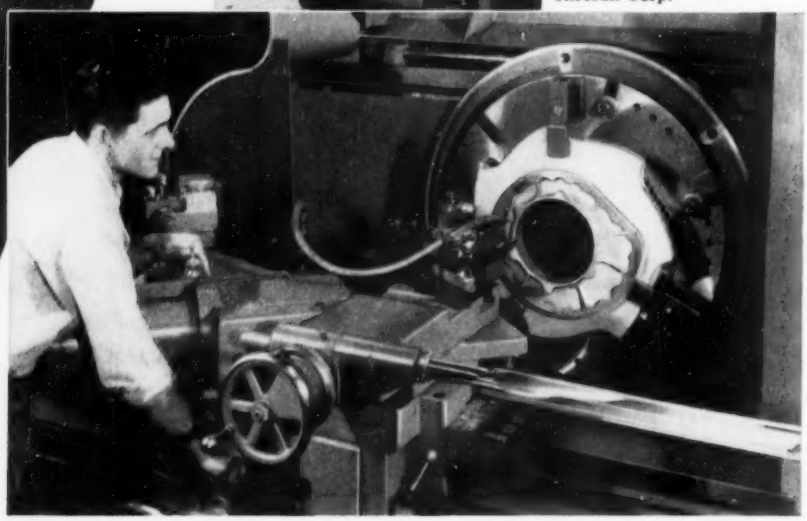
...Excellent Accuracy and Versatility
...Save up to 86% in Time
...Good Output and Design Features
...Best Available



Studebaker Corp.



Pratt & Whitney Aircraft, Div. of United Aircraft Corp.



Hotpoint Co.

T turning large diameter, thin wall, short length components

World leaders in jet engine production, here and abroad, have installed, tested and production-proved Lodge & Shipley T Lathes.

T Lathes are designed specifically for thin-wall, short length and large diameter work that characterizes jet engine production. These lathes have solved the problem of straight and contour facing, turning and boring parts formerly machined on over-size, over-costly, over-clumsy conventional lathes and boring mills. Far faster, more sensitive and accessible, they save cost, time, floor space and assure required accuracy.

Whatever your requirements or production, there is a T Lathe to cut time and costs on large diameter, short length parts machining. With priority assistance, you may be able now to obtain good delivery. Write for new literature and complete details.

8

There are now EIGHT DISTINCT 60" T LATHE TYPES, each designed to speed and simplify machining of any part you may have that is applicable to T turning.

THE **Lodge & Shipley** COMPANY

3059 COLERAIN AVENUE, CINCINNATI 25, OHIO

*T./M The Lodge & Shipley Co.

1,815

1,815 STANDARD GAGES ARE AVAILABLE FROM SIZE

on 4 week delivery

many items,
immediate delivery

2,000,000 blanks are in stock at all times for plain and threaded plug gages—reversible and taperlock—ring gages and snap gages.

New equipment and old know-how together serve you with an "in stock" delivery cycle on made to order items; the same know-how that originated the Size Control Centerless Lapper and reversible threaded plug gages—and revolutionized the manufacture of *all* precision gages.

SIZE control company
DIVISION OF THE AMERICAN GAGE & MACHINE COMPANY
2500 W. WASHINGTON BLVD. • CHICAGO 12 • MONROE 6-6710

SC

BURTON BROWNE ADVERTISING

NIAGARA Presents

outstanding design features:

Double End Twin Drive with double reduction gearing (for straight bends and smooth power application.)

A rigid One-piece Frame with permanently welded crown for minimum deflection and permanent alignment.

Laminated Non-Metallic Ways maintain accurate alignment and assure longest life of dependable service.

Deep Twin Plate Steel Bed with open slug clearance for multiple punching work.

Powerful Air Cooled Friction Clutch and Brake assures easy ideal "Press Brake Action".

Air Electric Clutch Control may be operated by palm buttons on ram or foot switch with provisions for "Inching", "Single Stroking" and "Continuous Run".

Reversible Flywheel can be pulled out of accidental stalls.

Power Adjusted Ram with self-locking adjusting screws.

Micrometer Dials accurately indicate position of ram so die settings can be quickly repeated.

Accessibility at rear with plenty of clear working space for safety.

Gages with full horizontal and vertical adjustment for front or rear of press.

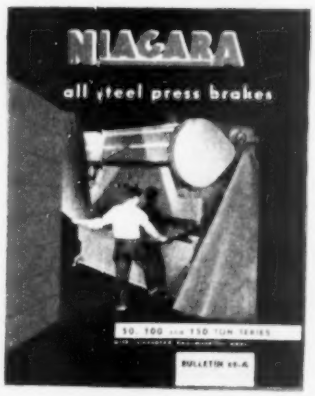
Angle Support Brackets and Bolster Plates quickly convert press for stamping operations without affecting bending ability.

All gears operate in totally enclosed sealed baths of oil.

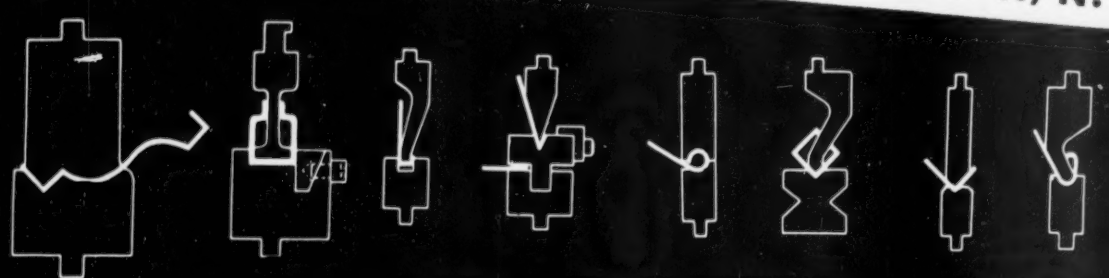
versatility of operations

BENDING	JOGGLING
FORMING	NOTCHING
DRAWING	PUNCHING
BEADING	PIERCING
CURLING	PERFORATING
CORRUGATING	SLITTING
BLANKING	TRIMMING
EMBOSSING	ETC.

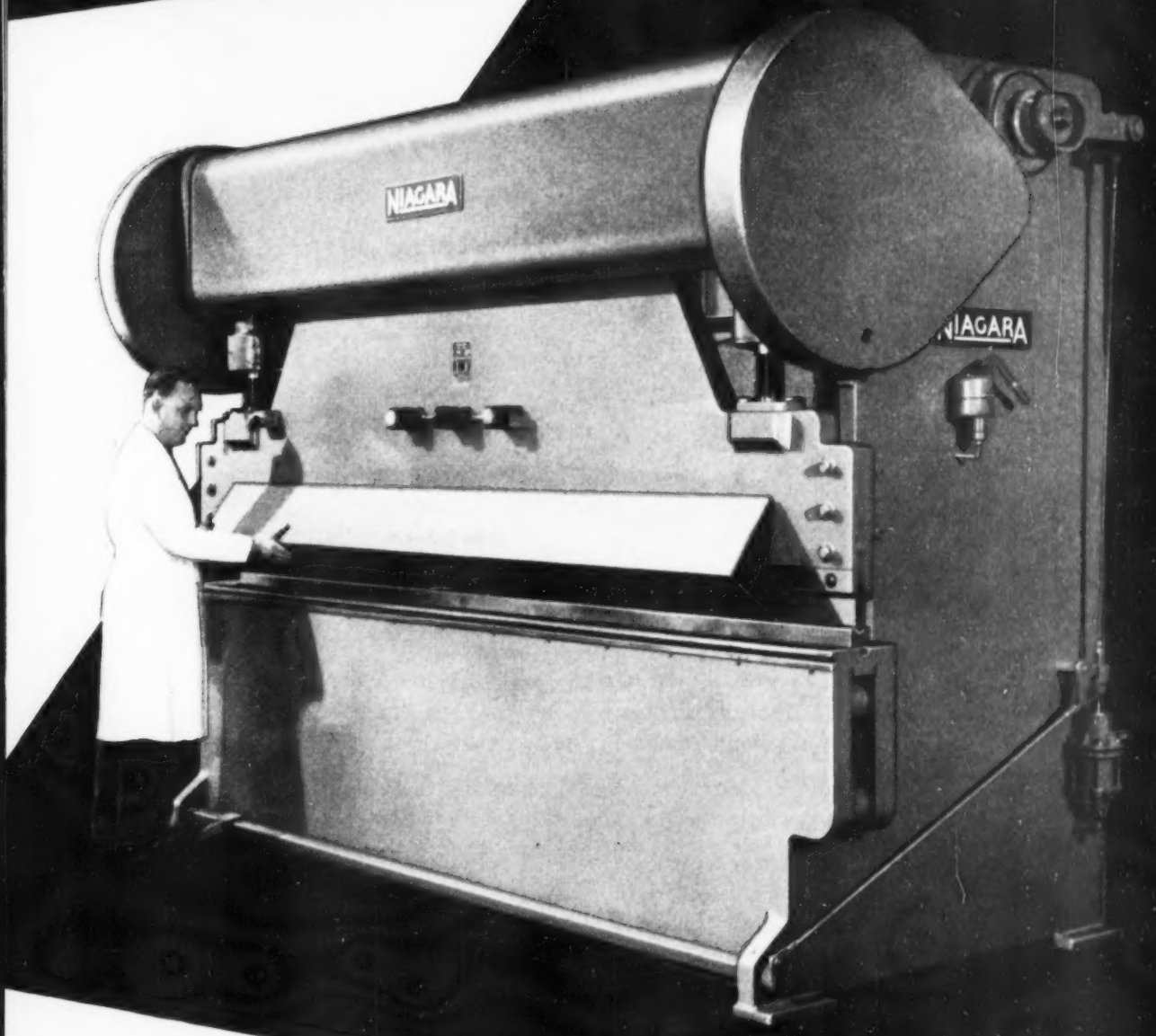
WRITE FOR BULLETIN 89



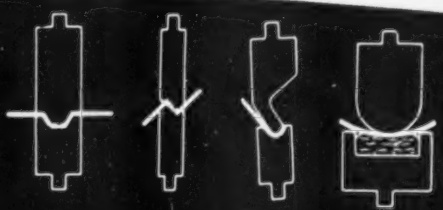
NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.



The Last Word in New All-Steel PRESS BRAKES



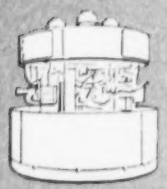
DISTRICT OFFICES: DETROIT, CLEVELAND, NEW YORK, PHILADELPHIA



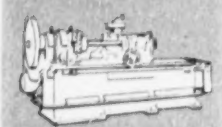
America's Most Complete Line of Presses, Shears, Machines and Tools for Sheet Metal Work

Dealers in principal U. S. cities and major foreign countries

12-S HOBBER

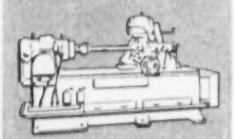


7-A ROTARY HOBBERS

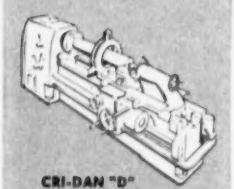


SH SPLINE HOBBER

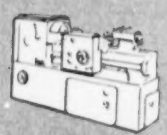
MODEL 40 THREAD MILLER



HT THREAD MILLER



CRI-DAN "D"



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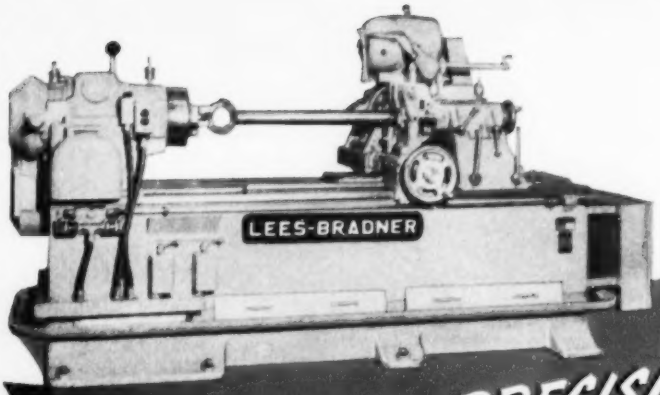


RUGGED PRECISION

of the Lees-Bradner Model HT Thread Miller

HELPS PRODUCE

RUGGED POWER

for Caterpillar

It's not surprising that Caterpillar should select the Lees-Bradner HT Thread Miller to help produce the famous line of Caterpillar earthmoving equipment. They have a lot in common.

Both are extra rugged and unusually versatile. Both are built for long, efficient service and both are leaders in their respective fields.

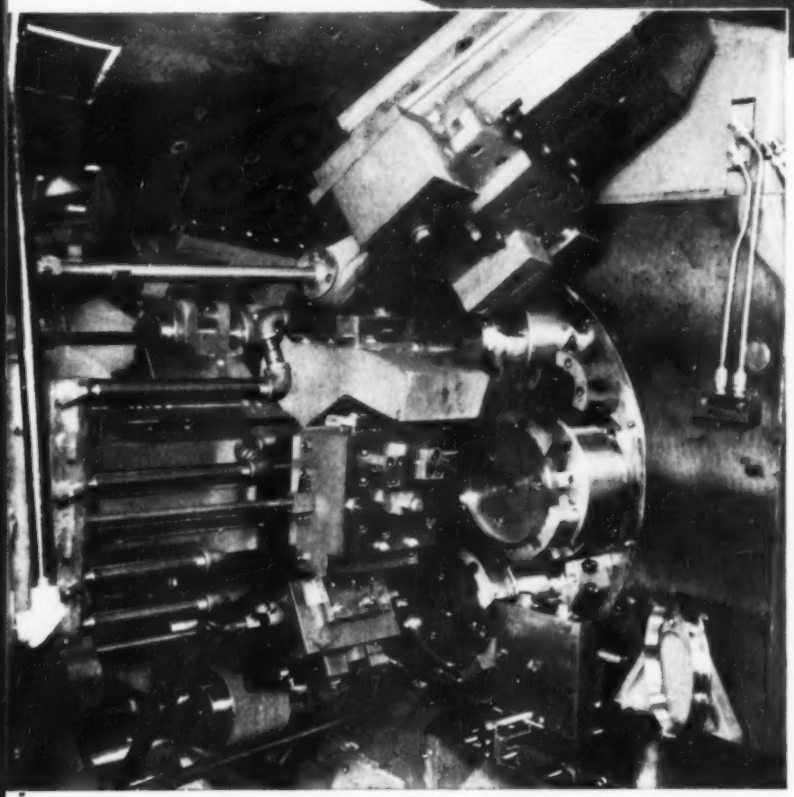
No matter what the threading job, chances are the Lees-Bradner HT Thread Miller can meet your requirements—for accuracy, speed and the wide range of work it can accommodate.

Call your Lees-Bradner representative for the whole story on the HT Thread Miller—or write us direct.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

ACME-GRIDLEY CHUCKERS take the TOUGH JOBS



This 8" Combustion Chamber Flange for jet engines is no job to be fooled with.

Machined from 8" diameter stainless steel blanks as shown, it presented first the problem of removing a lot of metal FAST—321 stainless is a difficult metal for precision results.

Tooling for accuracy and finish included both roughing and finish taper turning and boring attachments for the special angles and for holding the thin wall within .008 without danger of collapsing the piece.

All 13 operations were performed on the 10" Acme-Gridley Model RPA 6-spindle fully automatic Chucking Machine with carbide tipped tools at a net output rate *more than 6 times faster* than was possible on the turret lathe method formerly used.

Performances like this have demonstrated to the owners of more than 45,000 Acme-Gridley bar and chucking automatics that design rigidity and tooling ingenuity are your best insurance for sound production and profitable end results.

Acme-Gridley Chucking Automatics are built in 4, 6 and 8-spindle models with capacities ranging from 5¼ to 12".

★ **Ask for guaranteed figures on your work—Tough jobs or otherwise.**

JOB FACTS:

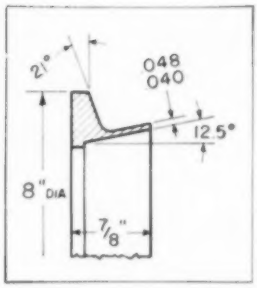
PART—Jet Combustion Chamber

SIZE—8" Diam., ⅞" long

MATERIAL—Type 321 Stainless Steel

OPERATIONS—13, all with Carbide Tools

MACHINE TIME—1 minute, 16 seconds

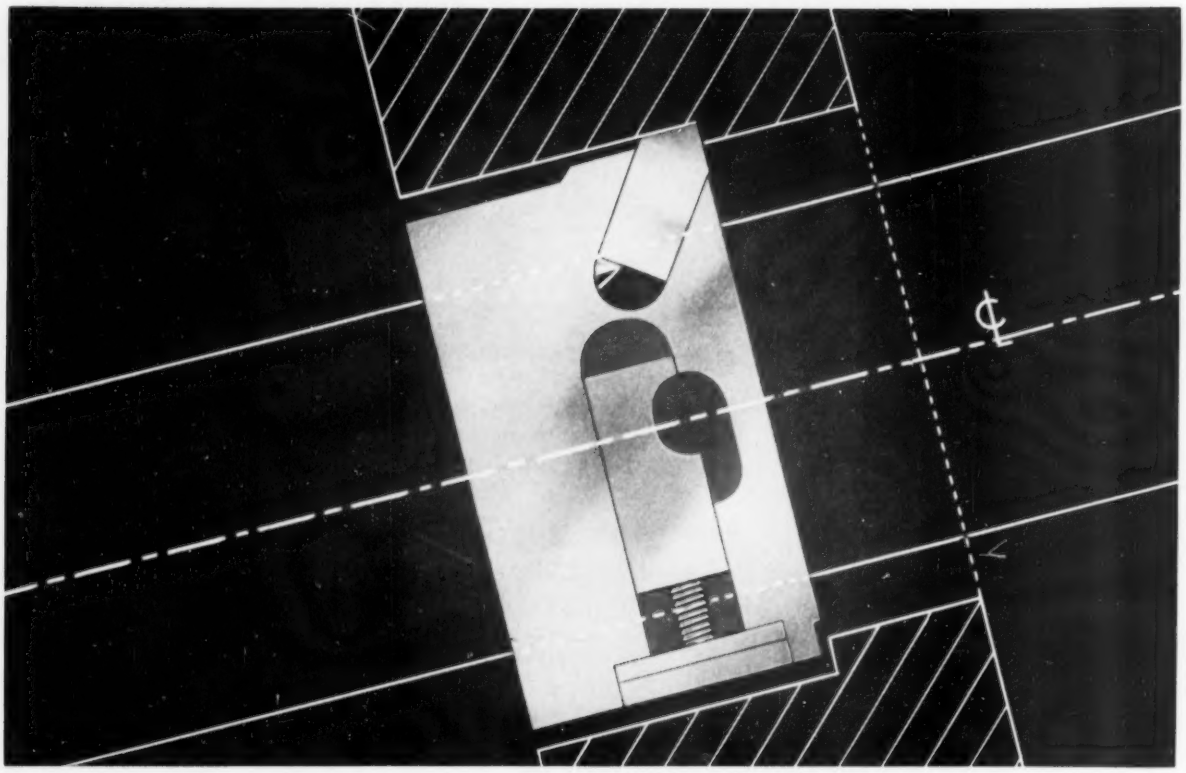


The NATIONAL ACME COMPANY

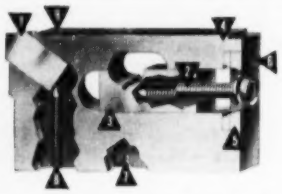
170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics, 1-4-6 and 8 Spindle—Hydraulic Thread Rolling Machines—Automatic Threading Dies and Taps—Limit, Motor Starter and Control Station Switches—Solenoids—Contract Manufacturing.

Get fast, positive line boring accuracy for 2½" to 17" dia. with...



DAVIS SINGLE CUTTER MICROMETER ADJUSTABLE BLOCKS



1. Cutter — Carried in stock of HSS or Tungsten Carbide tipped. Other materials per order.
2. Micrometer adjusting screw.
3. Gib—Hardened and precision ground to fit dovetail slot in block, allows for seating and accurately clamping of block with taper lock screw. The taper lock screw clamps the block firmly against the rear of the slot in the same manner as used in the Davis standard block type construction.
4. Keeper Plate — Retains adjusting screw.
5. Keeper Block — Retains adjusting screw.
6. Keeper Screws — Holds assembly in block.
7. Centers—For circle grinding cutter on diameter.
8. Cutter Support Screw — Supports and adjusts cutter for regrinding purposes.
9. Cutter Lock Screw—Locks cutter firmly in place.
10. Cover Plate — (Not Shown). Dovetailed to fit block prevents entrance of foreign matter into gib and screw assembly.

HERE's the way to boost efficiency on general purpose jobs that demand rigidity and a wide range of cutter adjustments.

In addition to regular line boring with either standard or special bars, Davis tools with the exclusive adjustable feature are easily adapted to counterboring, undercutting, grooving, facing or chamfering. Block and cutter adjust as a unit to assure full cutter support at all settings.

Made of high grade tool steel, hardened and ground, the blocks can be furnished with High Speed Steel, Cobalt, Stellite, Tungsten Carbide tipped or Tantalum Carbide tipped cutters.

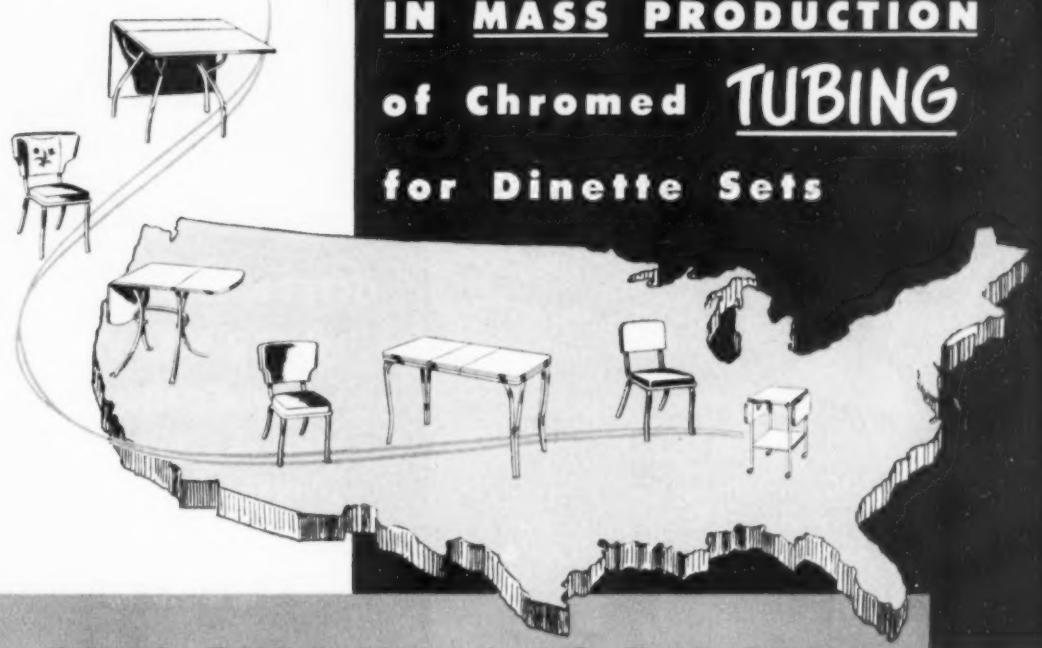
For details, write for bulletin No. 602.

If Davis can't bore it, it can't be done!

DAVIS BORING TOOL DIVISION
GIDDINGS AND LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN

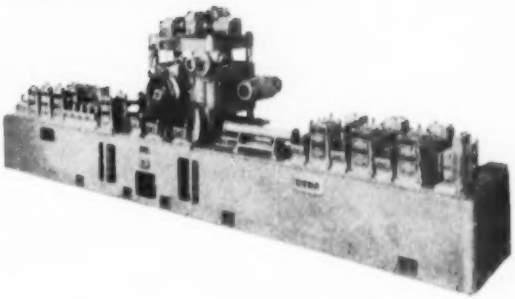
TO MAINTAIN NATIONAL LEADERSHIP..

DAYSTROM.. requires UNIFORMITY IN MASS PRODUCTION of Chromed TUBING for Dinette Sets



ETNA TUBE MILLS DO THE JOB at the rate of 120 FEET PER MINUTE!

Rigid standards of quality prevail at Daystrom Furniture Company. And to suit their *individual requirements*, Etna engineers designed and manufactured tube mills to produce steel tubing for Daystrom at the rate of 120 feet per minute! Etna Tube Mills mean faster, more uniform production of steel tubing for end uses as divergent as furniture and gas pipe. Consult Etna engineers for tube mills specially designed and constructed to suit *your* tubing requirements.



MANUFACTURERS OF BETTER TUBE MILLS... BETTER SWAGING MACHINES... FOR MORE THAN HALF A CENTURY

THE ETNA MACHINE CO.

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RED RING
INTERNAL-EXTERNAL
GEAR SHAVING
MACHINES
For the Precision
Finishing of Gears
Up To 120" PD
Other models available for gears
up to 220" PD
SPUR AND HELICAL
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM
NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN • DETROIT 13, MICHIGAN

New Counterbore

with interchangeable pilots

Photograph by Morton Berger

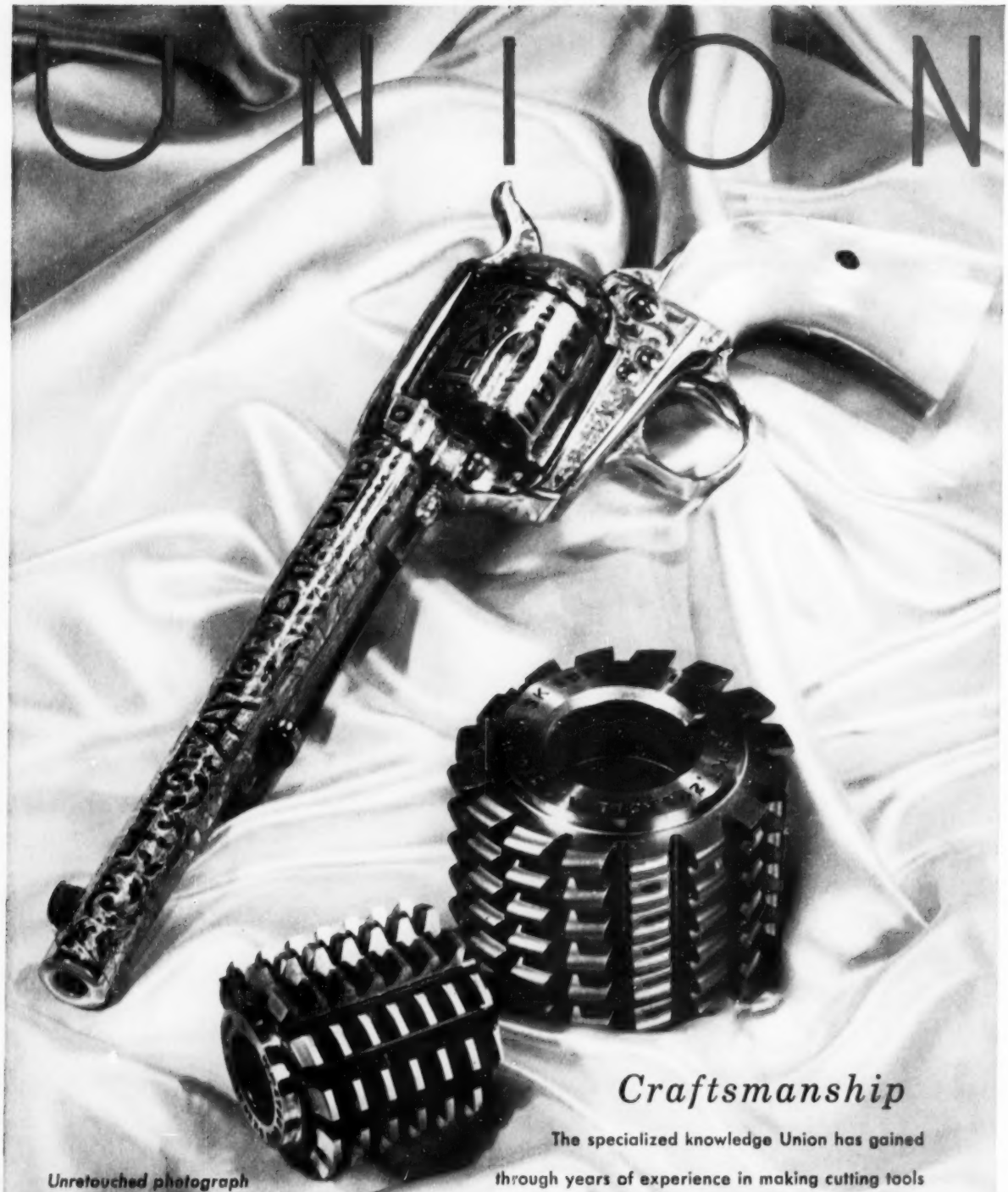
Introducing the Butterfield High Speed Counterbore and Spot Facer in standard and aircraft designs . . . latest example of Butterfield craftsmanship. *Ask your distributor.*

BUTTERFIELD

Union Twist Drill Company ***Butterfield Division*** *Derby Line, Vermont, U. S. A.*

DRILLS • TAPS • DIES • REAMERS • COUNTERBORES • SCREW PLATES

UNION



Craftsmanship

The specialized knowledge Union has gained through years of experience in making cutting tools is applied to every individual design it turns out.

Unretouched photograph by Morton Berger

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

Milling Cutters Gear Cutters Twist Drills Hobs Reamers Carbide Tools

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

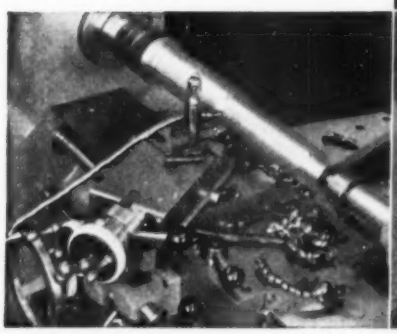
HARDINGE
ELMIRA, N.Y.

TOOL ROOM LATHE

Features QUICK *Feed Change*

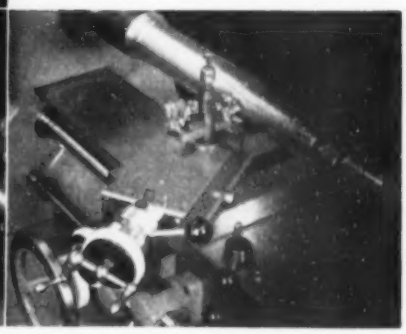
Simply TURN KNOB FOR EXACT FEED REQUIRED

CHANGE FEEDS WITHOUT STOPPING SPINDLE OR CHANGING OR SHIFTING GEARS



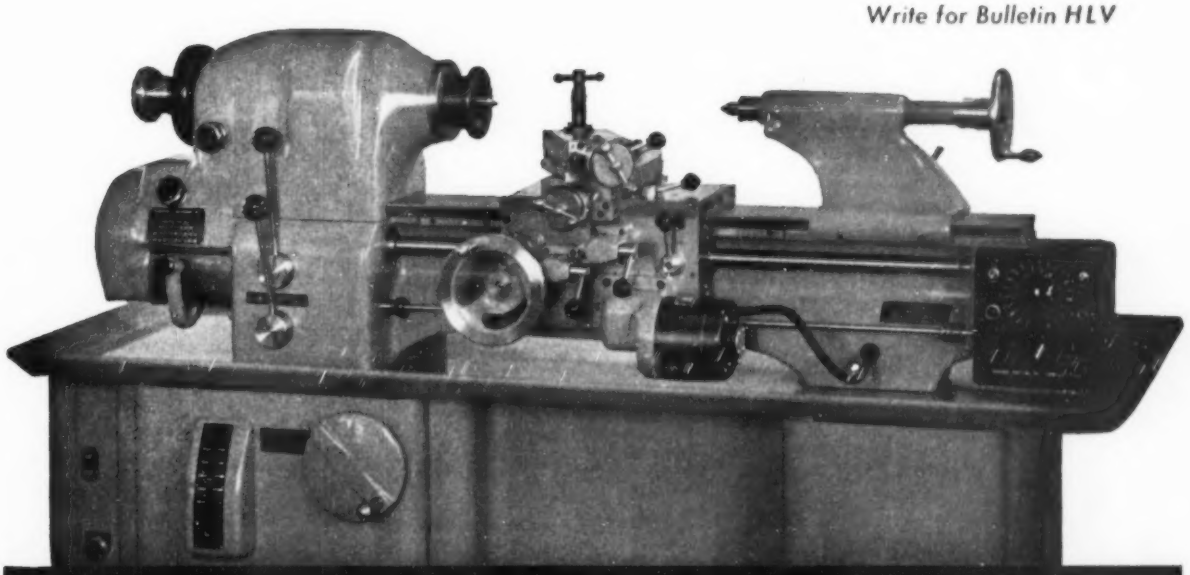
COARSE FEED

MEDIUM FEED



FINE FEED

Write for Bulletin HLV

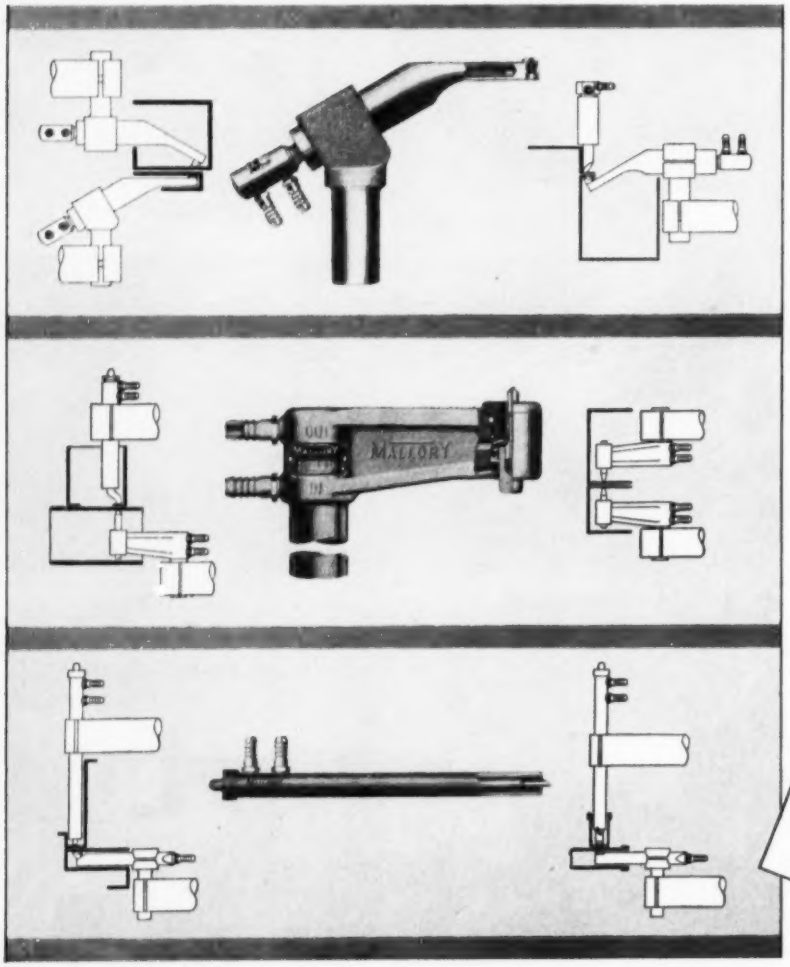


HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Hard to Reach Spot Welds Don't Need Special Holders and Electrodes

Before you start figuring on special holders and electrodes to handle that "special" job . . . be sure and check with Mallory first. A wide variety of standard holders and electrodes, available from stock, can be combined to fit practically any special welding job.

Here are a few examples of what we mean:



In over 25 years of resistance welding experience, Mallory has developed a complete family of holders and electrodes. A quick look through our Catalog 550C will give you an idea of the almost limitless variations of holders and electrodes that are available to handle your special job economically. Call your Mallory distributor and ask him for a copy, or if you prefer, write us directly.

Expect more . . .
Get more
from **MALLORY**

You can always depend on outstanding performance and engineering service when you call Mallory for:

Holders
Electrodes
Rods and Bars
Castings
Dies
Forgings

In Canada, made and sold by Johnson Matthey and Mallory Ltd., 110 Industry Street, Toronto 15, Ontario

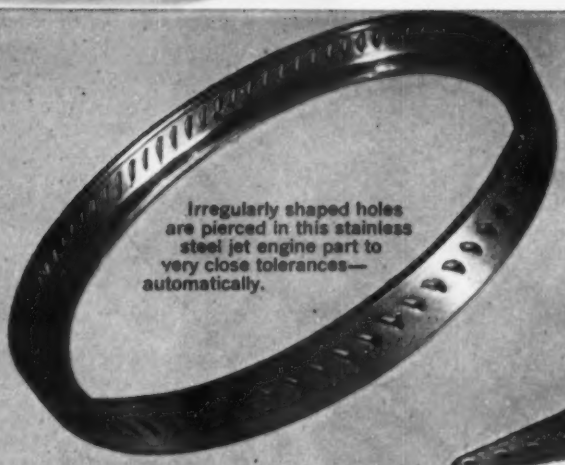
RESISTANCE WELDING ELECTRODES, HOLDERS, DIES, RODS AND BARS, CASTINGS, FORGINGS

P.R. MALLORY & CO. Inc.
MALLORY

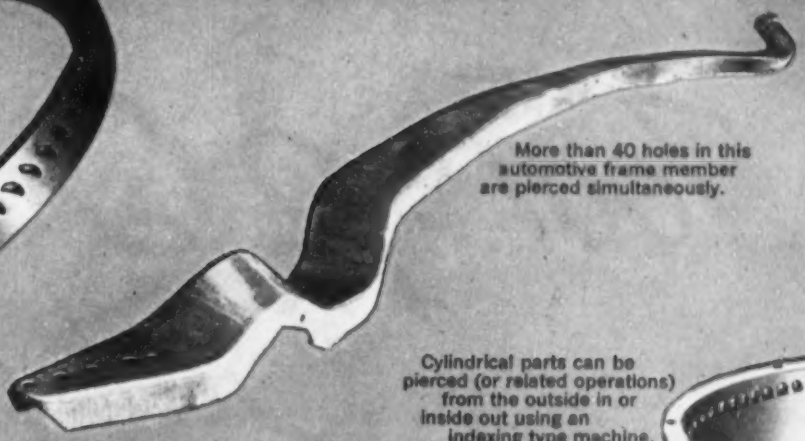
SERVING INDUSTRY WITH THESE PRODUCTS:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Dry Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO., INC., INDIANAPOLIS 6, INDIANA

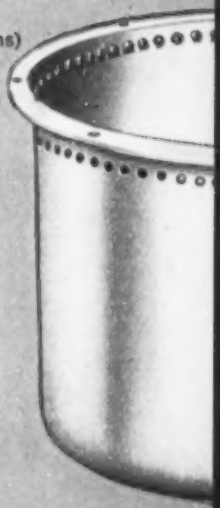
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio



Irregularly shaped holes are pierced in this stainless steel jet engine part to very close tolerances—automatically.



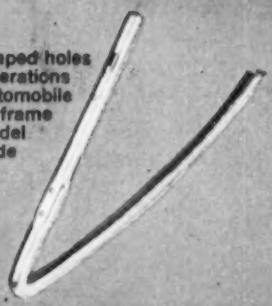
More than 40 holes in this automotive frame member are pierced simultaneously.



Cylindrical parts can be pierced (or related operations) from the outside in or inside out using an indexing type machine.

High Production Piercing...

IN A SINGLE SET-UP



Seven irregular shaped holes and two trimming operations complete this automobile door inner window frame in one setup. Model changes can be made at little expense.

Based on a recent development in piercing technique, you can pierce more holes simultaneously—faster and with greater accuracy—on Danly Metalworking Equipment. Eliminate awkward multiple handling . . . pierce all holes faster in a simple, single set-up.

Built specifically for your piece part, these are only a few of the advantages of Danly Hydraulic Metalworking Equipment:

FREE

Write for this Bulletin today!

Consider these important features!

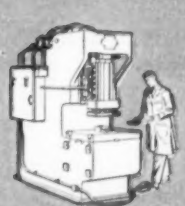
- ***HIGH CAPACITY***—Up to 225 tons available per cylinder.
- ***BREAKTHROUGH SHOCK PRACTICALLY ELIMINATED***—Permits greater capacity without hydraulic circuit or tool trouble . . . smoother, faster.
- ***AUTOMATIC STRIPPING***—An integral feature of every cylinder . . . each station hydraulically strips its punch. This unique action simplifies fixturing, is practically foolproof.
- ***ACCURACY, FLEXIBILITY***—Pierces practically any type of hole . . . round, oblong or irregular to very close tolerances.

DANLY®

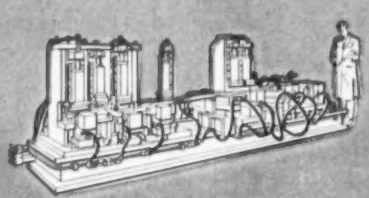
DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue • Chicago 50, Illinois

HYDRAULIC METALWORKING EQUIPMENT
MECHANICAL PRESSES 50 TO 3000 TONS

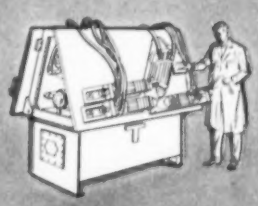
DANLY HYDRAULIC METALWORKING EQUIPMENT



General Purpose Gap Frame Piercing Press



Automotive Frame Piercing Machine



Automotive Inner Window Frame Piercing Machine

Jet Engine Shroud Ring Piercing Machine

Tool up Quick ...Cut Faster

with

CARMET CARBIDE METAL

STANDARD TOOLS AND BLANKS

Attention Distributors:

This ad in the leading trade papers creates business for you—if you stock CARMET. Stocks at 15 warehouses from coast to coast, plus stocks at Detroit plant, back you up. What you don't have in stock, we rush to you.

WRITE FOR CATALOG C-2 . . . also for price list . . . great helps when you need tools fast.

ADDRESS DEPT. AM-39

Need cutting tools in a hurry? Just name the standard styles and carbide grades desired . . . get prompt shipment from a big stock *near* you.

Our line of carbide "standards" is complete. It covers 90% of all single-point operations. CARMET standard tools come ready to use . . . easy to modify for special purposes, by grinding. Style C, illustrated, is designed particularly for conversion into various shapes for numerous applications.

Other standard CARMET styles also are immediately available from local stocks.

Order CARMET tools and blanks for better, faster, cheaper cutting. There is a grade to take care of every need.

• *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda and Jarvis Avenues, Detroit 20, Michigan.*

For complete MODERN Tooling, call

Allegheny Ludlum

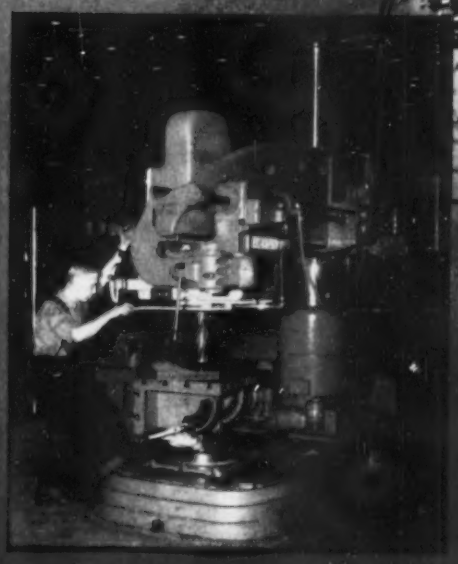
AL
FINE TOOL STEELS
SINCE 1854

W&D 3480

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.



This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

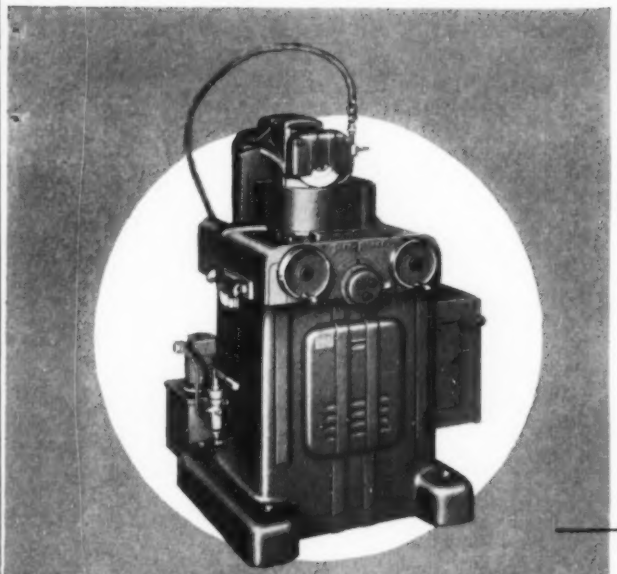
When the Decision's High Precision

Use these TAFT-PEIRCE Machines to—

Increase Accuracy

T-P #1 Surface Grinder.

Grinds surfaces to an accuracy, flatness, and finish formerly considered difficult or impossible. Full ball bearing construction provides extreme precision with almost effortless operation. Vernier attachments make horizontal and vertical settings to 0.0001". Tilting Wheelhead speeds and simplifies setups.



Reduce Grinding Time

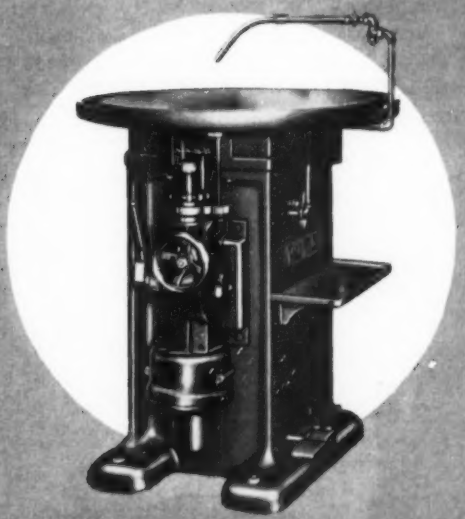
T-P 6″ Rotary Surface Grinder.

Developed for our own shops to provide high precision easier and faster than ever before. Tilting Wheelhead tips 30 degrees below wheel center . . . locks accurately in any position. Superpower magnetic chuck turns through 15 degree angle. Vernier feed permits .0001″ vertical settings.

Lower Lapping Costs

T-P 24″ Rotary Lapping Machine.

Offers a fast, accurate way to obtain superfine finishes and true contact surfaces. Low in original cost, economical to operate, it has the speed and capacity for rapid processing in small lot manufacture or tool room work. Available with plain plate for cylindrical work, grooved plate for flat work.



Eliminate Complex Tooling

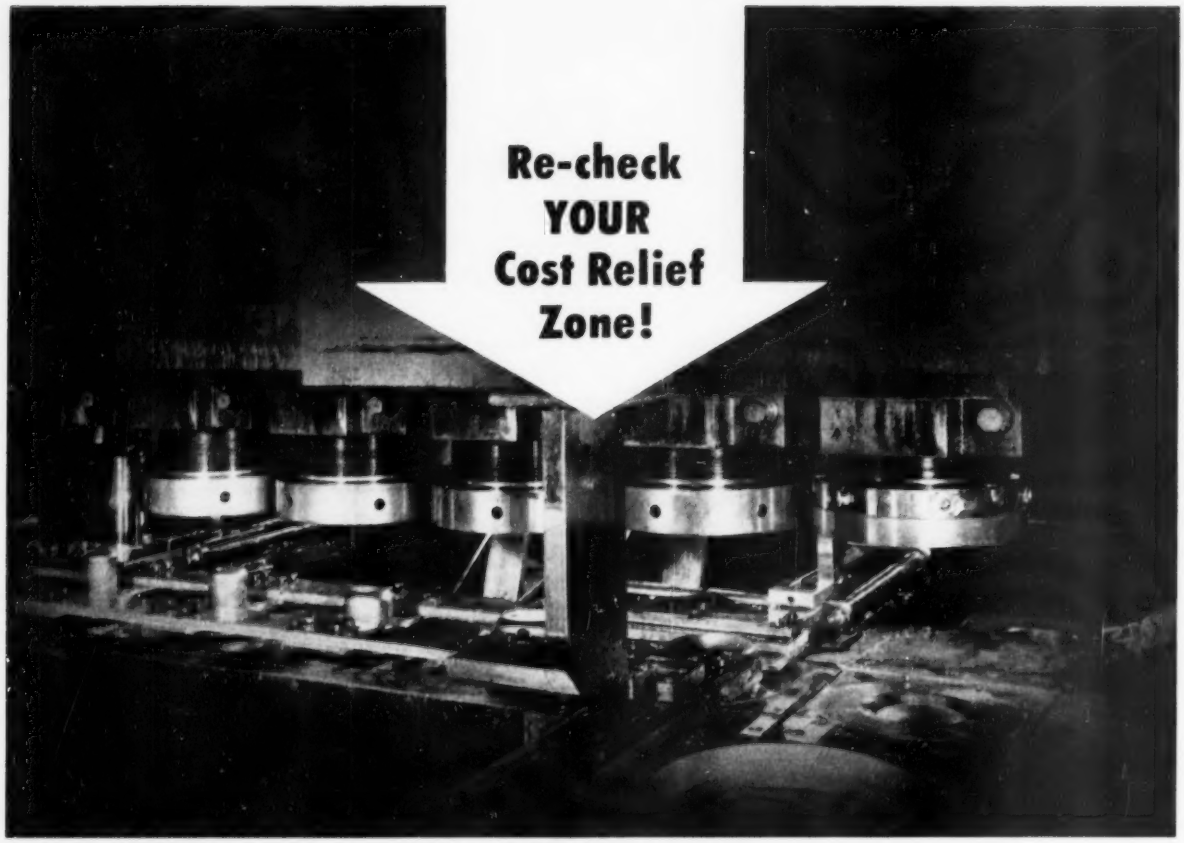
T-P Back Spot Facing Machine.

Simplifies counterboring or backfacing bosses that are hard to get at. Circular 31½″ work table has hole which allows shank of inverted counterbore to project through table. Groove in table collects coolant. Cutter speeds 170 to 300 rpm.; ½ HP motor.

For the complete story on these items and many more, get your copy of the New Taft-Peirce Handbook.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND



Every Man Responsible for Tooling and Production Can Take This Step Now and Get Results!

Re-check your *tools* and *dies* . . . investigate this immediate source for new cost economies like hundreds of other plants are doing! You'll often be able to reduce costly die maintenance, shutdowns for regrinding . . . and step up output between grinds.

Records in hundreds of plants prove it possible. Look at the job shown above. A re-check of these punches and dies that produce muffler heads on an automatic transfer press, showed that a different die steel with the following properties was needed: (1) More uniform, through hardening, (2) Higher wear resistance, (3) Greater safety and accuracy in heat treatment. It was found that all of these properties were provided by *one* tool steel—Carpenter No. 610 (Air-Wear). Now, after many months of dependable service, the No. 610 tools are still averaging 200,000 units per month, and costs are in line.

One such case is not complete proof. But when many other plants report similar cases of cost relief, it adds up to an opportunity for you. Try this now: Use the Carpenter Matched Set Method to select the one steel best suited to cut costs. This Method is backed by *dependable* tool and die steels that stay on the job. Then, for rush delivery, call your nearest Carpenter Mill-Branch Warehouse or Distributor. THE CARPENTER STEEL CO., 109 W. BERN ST., READING, PA.

Are You Missing These Opportunities In *Your* Cost Relief Zone?

- Less die finishing and adjusting
- Greater output between grinds
- Fewer heat treating failures
- Less machine downtime

On Job After Job Carpenter Matched Tool and Die Steels Have Made Them Possible!

Carpenter STEEL

Matched Tool and Die Steels

Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U. S. A. and Canada

This Tiny Tap Tells a Big Turning Story

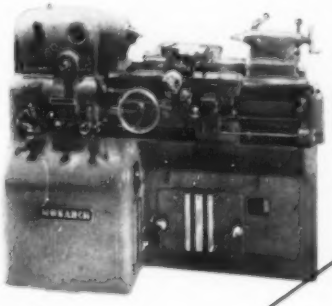
This tiny part portrays better than words the extreme accuracy you can expect from a Monarch 10" Model EE Precision Toolmaker's Lathe. The operation detailed below was actually performed on a standard lathe which is employed primarily to turn a variety of parts for small, precision, automatic tapping and drilling machines for the user's own manufacturing operations. These master taps which he chases occasionally are needed to make a master die. This, in turn, is used to produce working taps in quantity. End use is tapping a hole in the end of surgical needles to permit holding of the suture.

How surgeons thread the needles, we'll never know. We do know that in all probability you'll never have to work as fine as 200 threads per inch. But accuracy like this can be just as important to you, regardless. With the Monarch 10" Model EE, as a look at the listed features will at once reveal, you get a machine unequaled for precision, speed and sensitivity. Like most of the Monarch line of lathes, it can be furnished with "Air-Gage Tracer" controls . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

Surgical needle master tap—overall length, ¾"—diameter, .0218"—threads per inch, 200—thread accuracy, lead within .0001 over the entire threaded length of ⅜".

MONARCH 10" MODEL EE FEATURES

- All electric drive direct to spindle through multiple "V" belts. No gears in headstock.
- A true high speed lathe for small work. Available with speed range up to 40 to 4000 R.P.M.
- Totally enclosed, automatically lubricated end gearing and gear box.
- Flame hardened and ground ways for both carriage and tailstock. Bed all in one piece—no inserts.
- American standard Camlock spindle nose—for quick, rigid and accurate chuck and fixture mounting.
- Easy, fatigue-free operation. Base design permits operator to work close comfortably. He gets production—not backaches.
- Over 6000 10" Model EE machines in use.
- The only small lathe available with anti-friction bearing taper attachment.
- For thread chasing up to 100% faster, has exclusive combination of electric lead-screw reverse and variable reverse speed control.



Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

Gentlemen:
Please send me without obligation your complete illustrated Booklet #302, covering the 10" Model EE Monarch Sensitive Precision Toolmaker's Lathe.

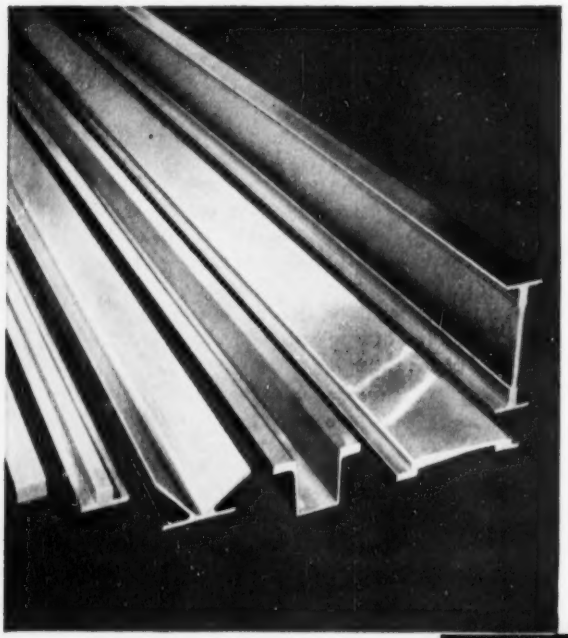
NAME _____ TITLE _____

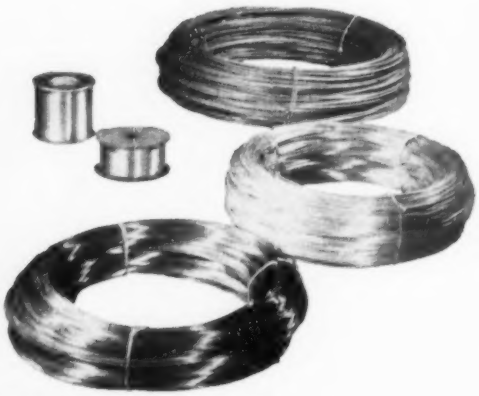
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

KAISER ALUMINUM PRODUCTS



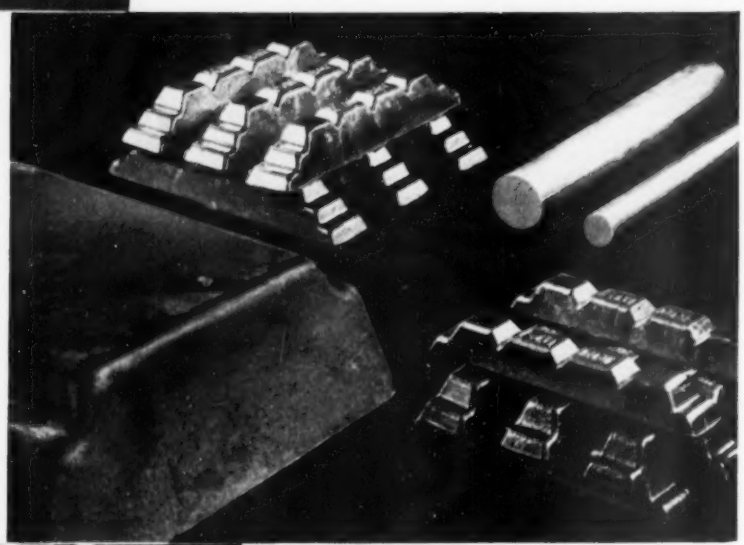


Wire

Supplied as round drawn wire, hexagonal wire, rivet wire, welding wire, screen wire, EC wire, redraw wire.

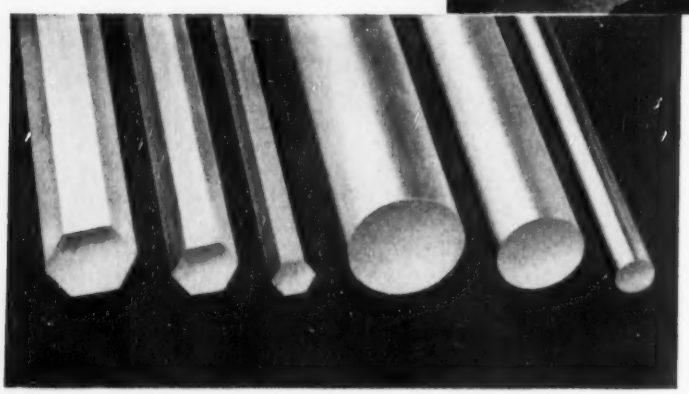
Extruded Shapes

Available in solid, rod, bar, semi-hollow and hollow shapes in all standard alloys. Also available in tubing.



Pig, Ingot and Billets

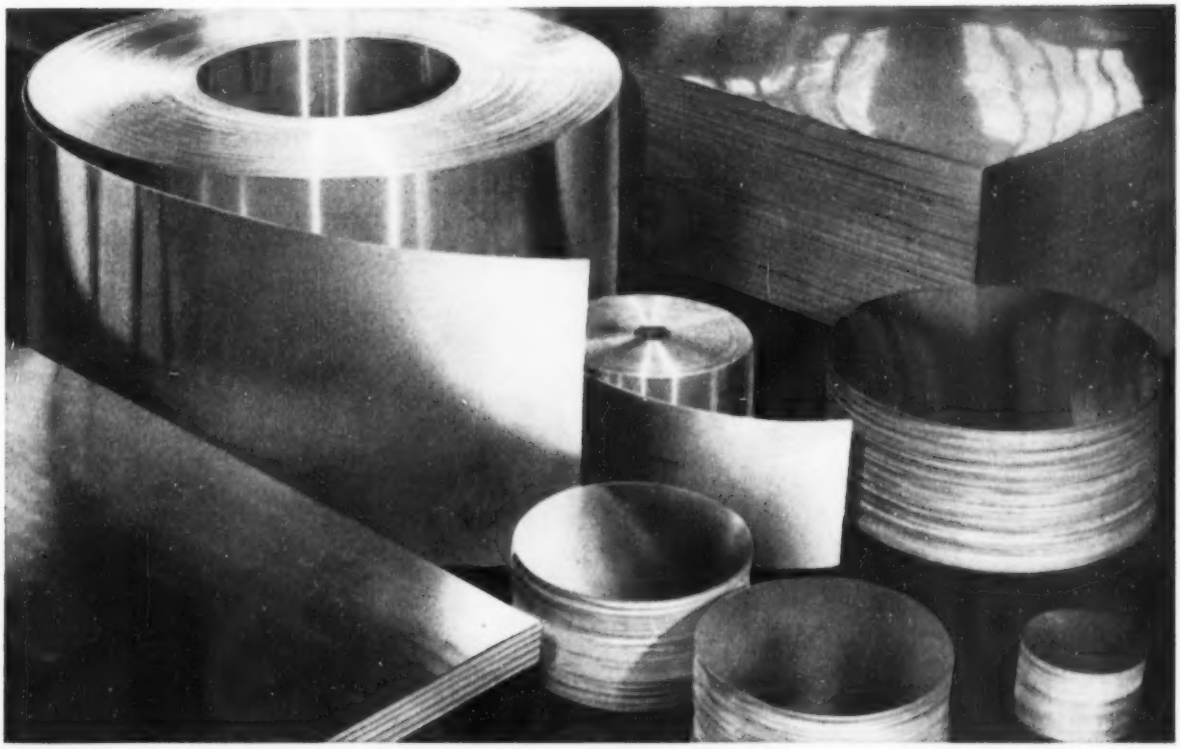
Kaiser Aluminum produces Pig, Ingot and Extrusion Billets in a range of alloys and sizes to meet your specific requirements.



Rod and Bar

Available in a wide range of alloys in rolled and cold finished rod and bar, screw machine stock, hexagonal bar, redraw rod, EC redraw rod, rivet rod and round forging stock.

for you...the nation's fabricators



SHEET and PLATE to meet your specifications

Supplied as flat sheet, plate, coil sheet, circles in a complete range of alloys, sizes and tempers. Specialty sheets also produced to fill volume requirements. In addition, Kaiser Aluminum engineers will be glad to work closely with you to select proper alloys or to help improve production methods.

To SUPPLY you and thousands of other fabricators with aluminum in the forms in which it can be used most economically, Kaiser Aluminum produces a broad line of basic and semi-finished mill products.

More than 85 per cent of Kaiser Aluminum's total production is sold in the form of these mill products for fabrication by customers. It's the highest percentage in the industry.

Kaiser Aluminum has earned an unsurpassed reputation for promptness, dependability, and helpful service in providing these products.

Included among Kaiser Aluminum service facilities are: the Sales Engineering Department, the Development Division, and the Metallurgical Research Division—all invaluable sources of experienced assistance and technical data to users of Kaiser Aluminum.

For complete information, call or write any Kaiser Aluminum sales office. Located in principal cities. See our catalog in Sweet's Product Design File or write for copy. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Other Kaiser Aluminum products include: Industrial foil and electrical conductor. Kaiser Aluminum also supplies household, freezer and broiler foil for home uses, Shade Screening and Siding for the building industry and corrugated Roofing Sheet for farm and industrial buildings.

Kaiser Aluminum

setting the pace—in growth, quality and service

MAIL COUPON FOR FREE HANDBOOK

Send now for the new Sheet and Plate Handbook. 152 pages. A "must" for every fabricator of aluminum.

KAISER ALUMINUM & CHEMICAL SALES, INC.,
366 KAISER BLDG., OAKLAND 12, CALIFORNIA

Please rush my free copy of "Sheet and Plate Product Information."

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Firm_____

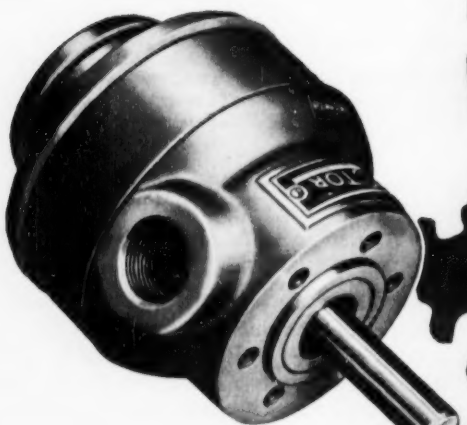
Address_____

City_____ State_____

design puzzles . . .

production puzzles

solve both with . . .



GEROTOR hydraulic pumps

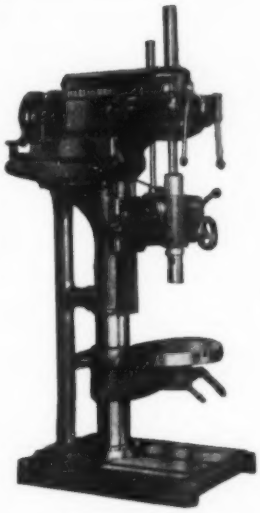
In many a product . . . on many a production line . . . Gerotor hydraulic pumps have proved to be the one sought-for element, the one most efficient answer to an engineer's problem.

Chances are that a Gerotor can fit into **your** picture, too. Eleven standard pump sizes . . . plain, base or flange mountings . . . for pressures up to 1200 p.s.i. continuous, 1500 intermittent.

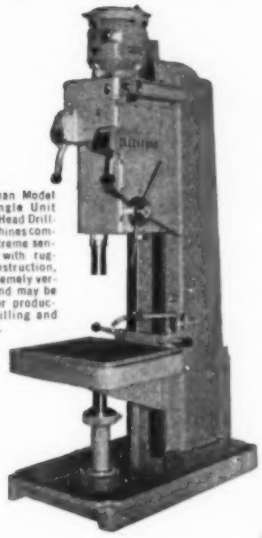
GEROTOR MAY CORPORATION, BALTIMORE 3, MARYLAND

THE CLEEREMAN LINE

OF PRECISION JIG BORERS and DRILLING MACHINES

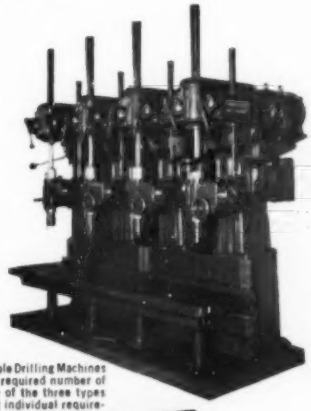


Cleereman Round Column Drilling Machines produce accurate holes at high speed and at low cost and are general purpose machines with high production.



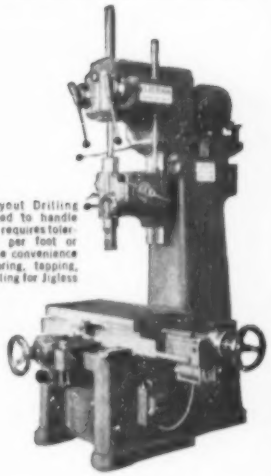
Cleereman Model 325 Single Unit Sliding Head Drilling Machines combine extreme sensitivity with rugged construction, are extremely versatile and may be used for production drilling and tapping.

Cleereman Jig Borers noted for unexcelled precision, extreme accuracy, ease of operation in small lot production and in producing tools, dies, jigs or fixtures. Models available with electrically controlled prepositioning.



Cleereman Multiple Drilling Machines consisting of the required number of machines of any of the three types supplied to meet individual requirements.

Cleereman Box Column Drilling Machines have an exceptionally rigid construction for continuous heavy duty work combined with accuracy and the speed required for low cost production.



Cleereman Layout Drilling Machine designed to handle layout work that requires tolerances of .001" per foot or broader. Extreme convenience for drilling, boring, tapping, reaming and milling for jigless manufacturing.

BRAMM Machinery & Engineering Company

General Office
400 West Madison Street, Chicago 6
Representatives in Principal Cities

Affiliated with..

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

Prove It To Yourself!

...You Can Now Obtain Precision Flatness, Finish and Parallelity in Production Quantities

Many manufacturers of pumps, compressors, valves and other equipment containing liquids or air under high pressures are now using production lapping to great advantage—have eliminated gaskets in mating surfaces, have improved product performance. This has been made possible through the extreme accuracy of work produced by the Lapmaster in production quantities. Micro-inch finishes of 2 to 3 RMS are common. Surface flatness can be held to less than .0000116".

A TYPICAL CASE

Four Model 72" Lapmasters were installed in an automotive plant for lapping the joint faces on large castings. These Lapmasters are able to keep pace with the high production requirements of automotive plants because there is no downtime required for reconditioning the lapping plate. In addition, parts lapped by the Lapmaster can be brought directly from the milling operation to lapping. Intermediate grinding operations are eliminated. Still another important feature is the fact that joint faces are lapped so accurately, gaskets can be eliminated in final assembly; the resulting metal to metal contact also eliminates distortion caused by the conventional use of gaskets.

Use Our
Free Laboratory Service
to Determine Your Exact Needs

To determine whether lapping can be practical and profitable for you, we maintain a laboratory for lapping sample parts. If you believe it offers possibilities we invite you to send prints of the parts, together with surface finish requirements and production desired. In addition send several parts for test lapping. We can then give you the facts on what you can expect from the Lapmaster. There is no obligation for this service.

Additional Data

on the complete line of Lapmasters is available on request, also new information on Measuring Flatness. Write for your copies today.

Crane Packing Company, Dept. AM 3 1836 Cuyler Avenue, Chicago 13, Illinois

JOHN CRANE

CRANE PACKING COMPANY

Red Shield says:

"STANDARD for tough jobs since 1881"

as near as your telephone

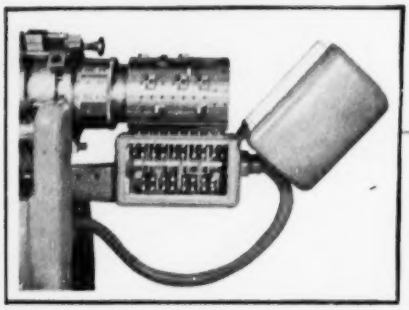
Call your Industrial Supply Distributor for Shield Brand Reamers. Specialized factory service available everywhere.

STANDARD TOOL CO.

3950 CHESTER AVENUE — CLEVELAND 14, OHIO

NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

You'd have to see the Gildematik 16-station Turret Lathe in action to believe all it does!



Speeds, feeds and direction of rotation for each of the 16 tool positions on Gildematik vertical drum-type turret can be *preset* in automatic cycling sequence by trip dogs on protruding end of turret. On indexing from one tool hole to next, trip dogs actuate electrical servo units, which pass on impulses to hydraulic controls. Speeds, feeds and direction are shifted instantaneously. *Right:* Gildematik RV 50 on the job at Special Screw Products Co., Bedford, Ohio.

Drum-type turret has electro-hydraulic preselection of feeds and speeds

Just imagine these operating features on your production line:

16 tool positions to carry bar through complete machining cycle to fine finished part—no secondary operations. Cuts machining time up to 50% on small work.

Automatic cycling by simple preselector controls! Electro-hydraulic servo units engage preset speed (from 11-2000 rpm), feed and direction of rotation for each tool...in fraction of a second.

Economical production even on runs of 20 pieces or less.

Quick, easy changeover from automatic to manual operation—without resetting automatic controls. Under manual control, speed and feed for next operation can be preselected while one operation is in progress.

Turret can be swung around on its own axis for facing, forming, plunge cutting and cutoff operations.

Easy maintenance...gears and hydraulics can be moved out of machine as a unit and be replaced in 15 minutes. Extra gear boxes carried in stock in Cleveland.

Yes, the Gildematik is an amazing machine. Those who saw it—and bought it—at the Tool Show all agree. So will you when this high-speed performer goes to work in your plant. Don't delay getting the whole Gildematik story—write today.

The Special Screw Products Co. bought a Gildematik on sight and got these results:

Says Mr. D. M. Douglas, Plant Manager:

1 SET-UP INSTEAD OF 2

"Machining male and female pipe tees and ells from stainless steel forgings required two set-ups on a conventional turret lathe. With the 16 tool positions on the Gildematik we turn out finished fittings with *one* set-up."

ELIMINATED SECOND OPERATION

"Machining the recess on another part after drilling and tapping previously called for a second operation. With the duplicating attachments on the Gildematik, we machine the recess with a point turning tool, without chatter, and eliminate the second operation."

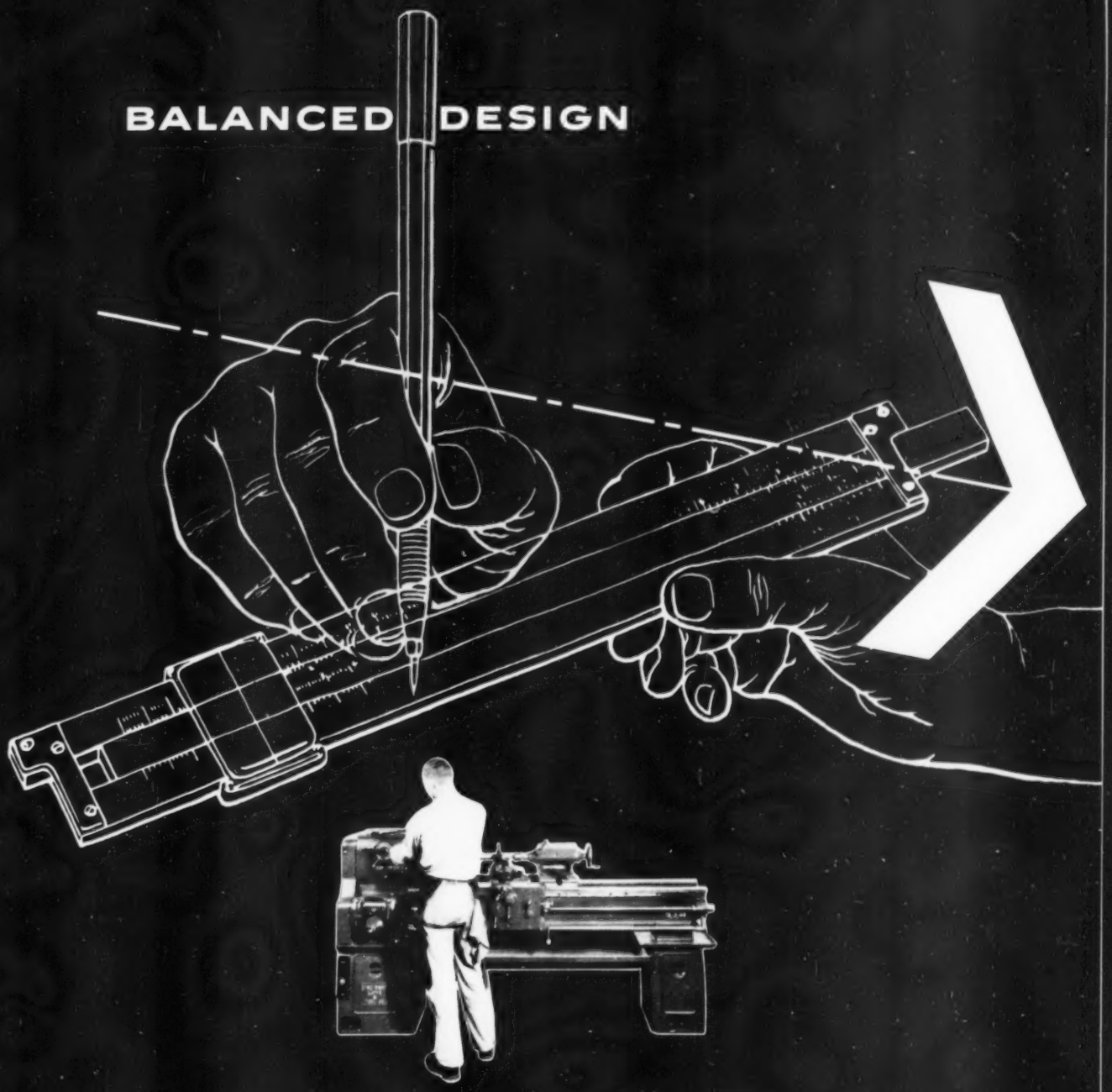
Engineered servicing from Orban Service Centers in Cleveland, Detroit, Newark. Prompt delivery of stock parts from Cleveland.

KO CO. INC INDUSTRIAL IMPORTERS

KURT ORBAN COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Ave., Cleveland 3 • 19450 James Couzens Highway, Detroit 35
1939 Santa Fe Ave., Los Angeles

BALANCED DESIGN



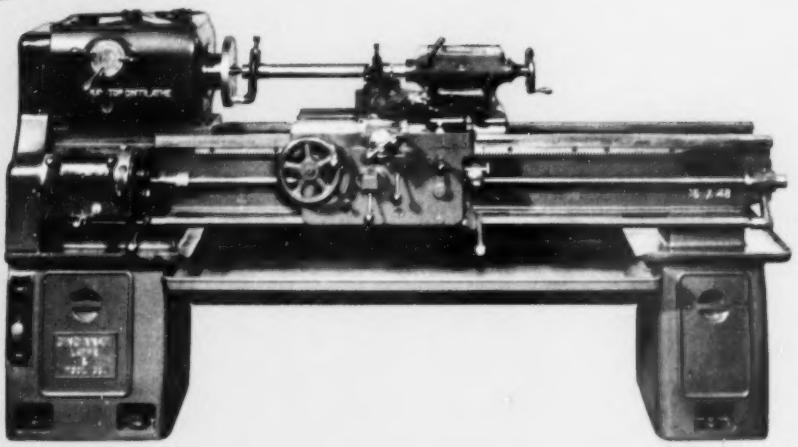
Tray-Top Cintilathes make friends of your customers by helping you deliver top quality work at less cost. Every pound of weight, every gear, shaft, bearing, every working component, every control — does its part to improve your products and lower your costs. If your business is competitive, compare the work you are getting from your present machines with the performance you can expect from Tray-Tops per dollar invested. Your Cintilathe dealer will gladly arrange a demonstration.

best buys in their class!

CINTILATHE

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

MORE **QUALITY** FEATURES



WIDER WORK RANGE

MAXIMUM CONVENIENCE

SIMPLE INSTALLATION

EASY MAINTENANCE

SUSTAINED ACCURACY

ECONOMY PRICED

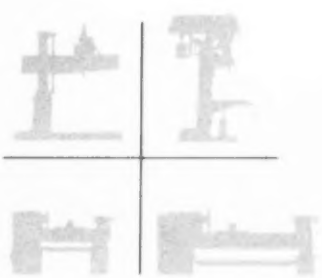
12 spindle speeds in geometric progression with an all geared transmission . . . Large spindle mounted in three precision anti-friction bearings . . . Direct-reading color-match speed shift . . . Double walled, one piece apron with automatic lubrication . . . Totally enclosed, automatically lubricated, quick-change gear box, incorporating leadscrew reverse . . . Flame hardened gears in headstock, quick change box, and apron . . . Ground bedways (flame hardened at extra cost).

CINTILATHES: The complete, balanced line,
Tray-Top for light duty (engine, toolroom and gap bed models),
10", 12½", 15", 18" sizes, 18" to 114" center distances.
Model LT for medium duty (engine and gap bed models).
16", 18", 20", 24" sizes, 30" to 264" center distances.
Write for catalogs and name of your nearest dealer.

best buys in their class!

CINTILATHE

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.



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Lighter . . . faster Rotor grinders

"PAID OFF" in 48 days

JOB: Grinding welds on truck cabs. Using slow, 20-pound electric grinders. Only 2800 r.p.m. under load.

SOLUTION: Rotor Application Engineer suggested changing to Rotor 6" Air Grinders that weigh only 9¾ pounds. Speed 5300 r.p.m. under load.

RESULTS: Stepped up metal removal, increased wheel life. Lower maintenance. Cut man-hours per cab. Savings "paid off" cost of Rotor Grinders in 48 days—on basis of 50% use factor.

Call in your Rotor Application Engineer for a study of your portable tool operations to suggest improvements. Write for Catalog No. 38.

AIR O'TOOL

ROTOR GRINDER FACTS

LIGHTER . . . Unique two-blade design and magnesium handles. Easy to move around. 6" Rotor Grinder weighs only 9¾ lbs. . . . 8" only 11¼ lbs.

FASTER . . . Rotor Grinders, known as the "Power Plus" line are recognized everywhere for their high speed *under load.*

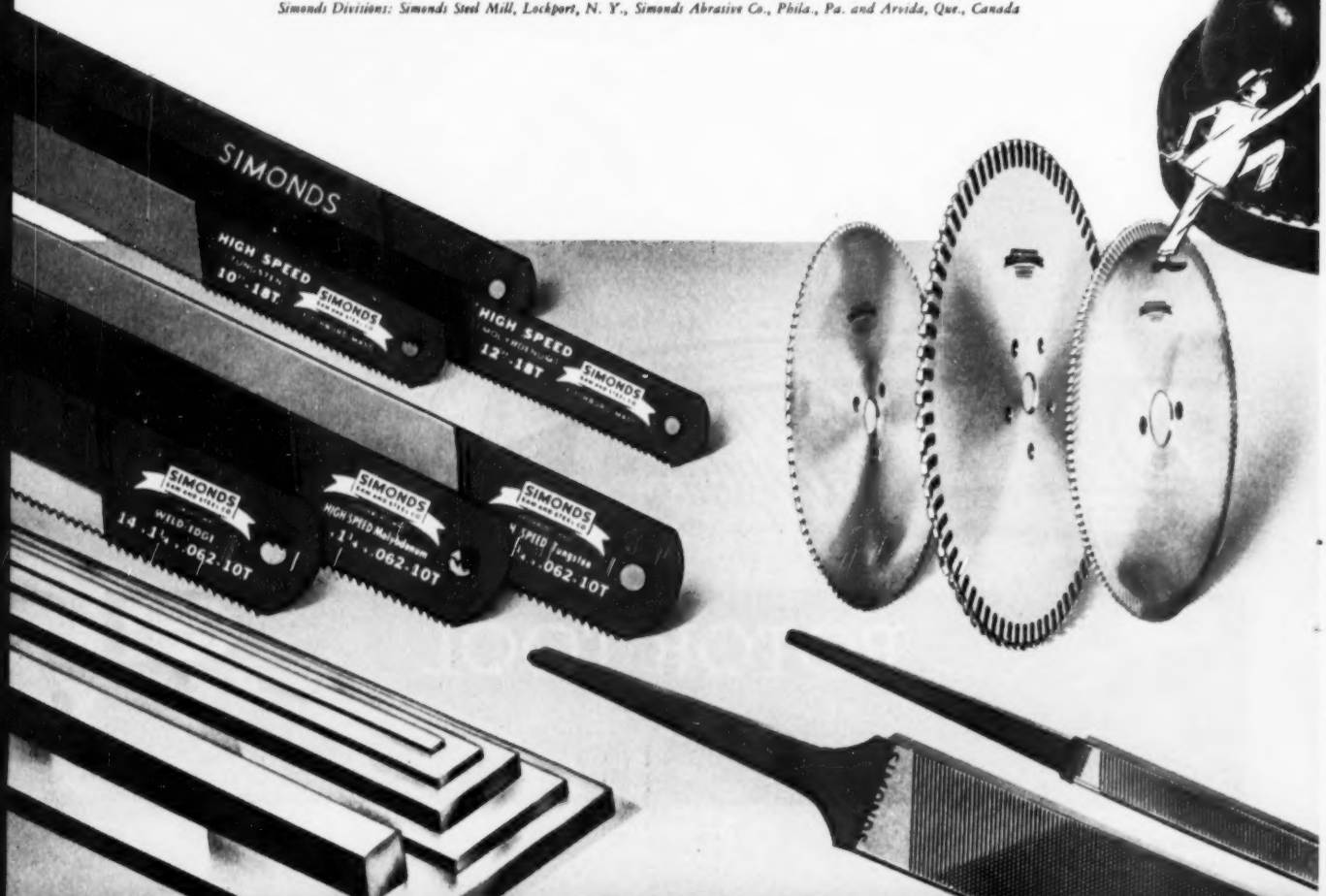
How many people would to fill this one man's

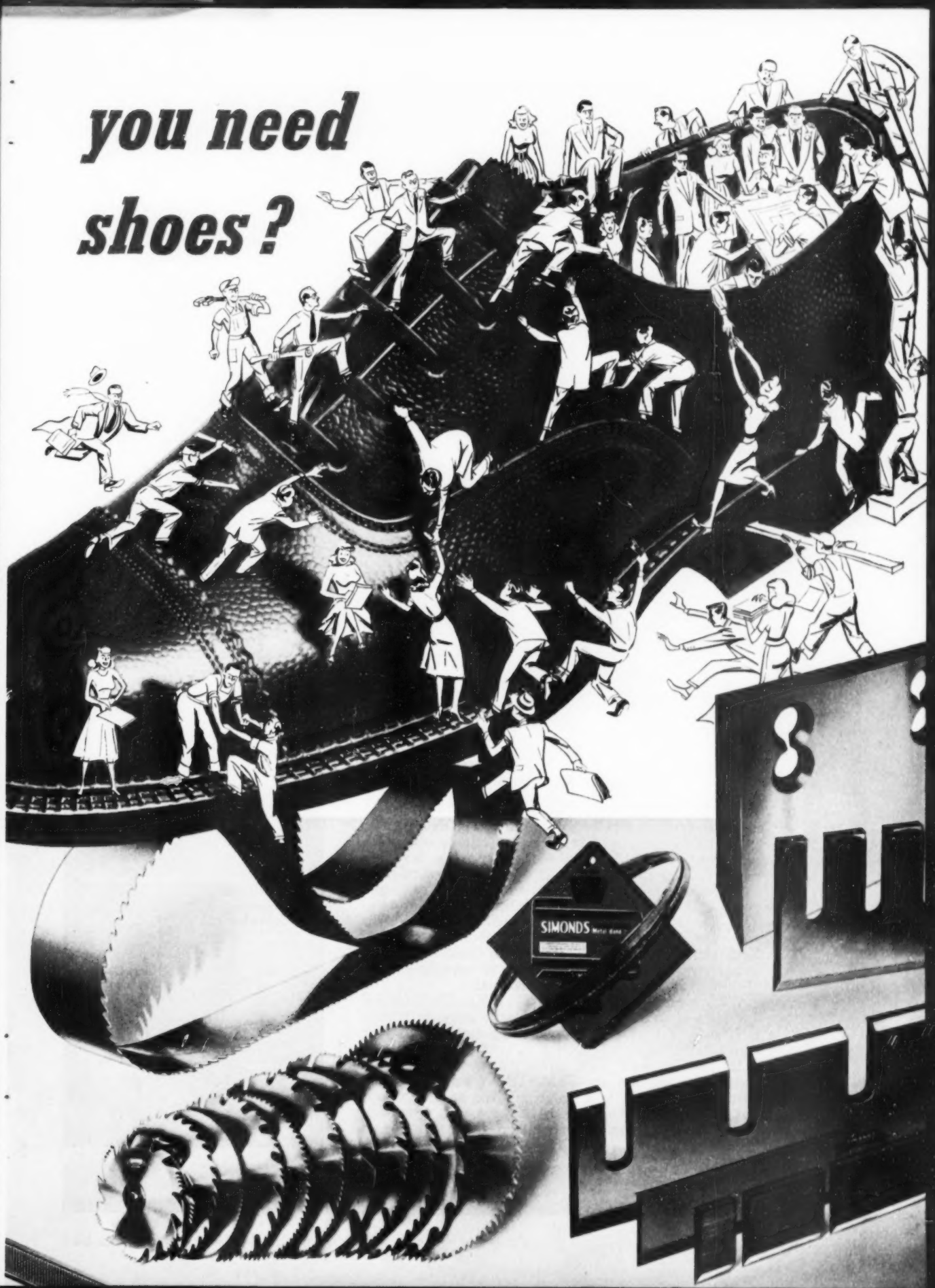
YOUR SIMONDS DISTRIBUTOR does all these jobs for you: He carries your stock til you need it, *then delivers it right now* (a good thing to remember in your next "tight spot"). He saves you endless procurement headaches, as well as ordering, requisitioning, bookkeeping and other paper work. What's more, he and many of his salesmen are graduates of Simonds' famous "Little Red Schoolhouse". So they know how to apply cutting tools, how to make them pay off in best results, and how to anticipate your maintenance and replacement needs.

All these services save you work, *cut your costs.* That's why it comes under the head of smart business to standardize on Simonds on all orders for saws, knives and files . . . and to place all orders with your SIMONDS DISTRIBUTOR. If you don't happen to know who he is, we'll be glad to put you in touch with him. Just write:

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon. Canadian Factory in Montreal, Que.
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

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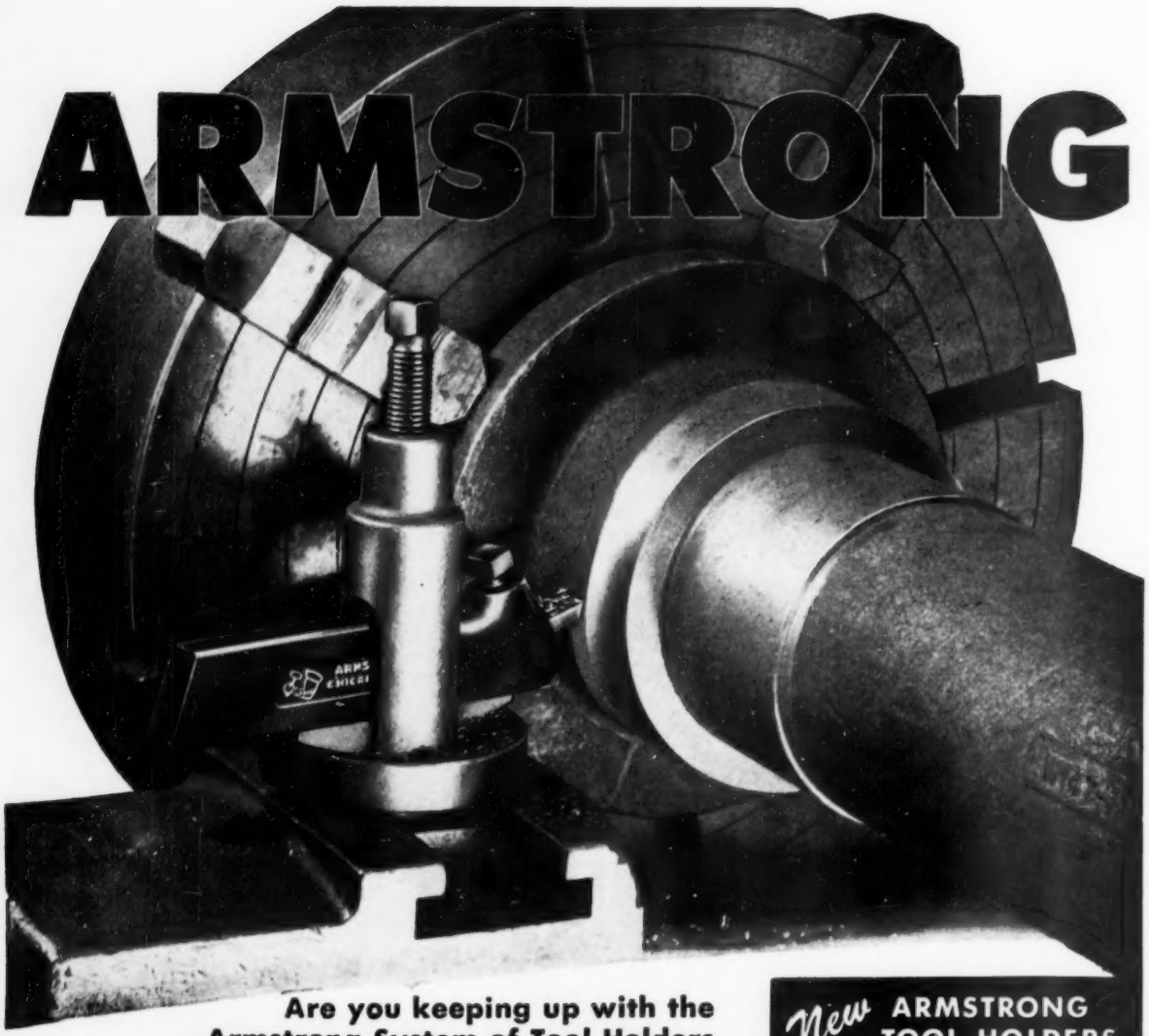
shoes ?
SIMONDS

ARMSTRONG



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

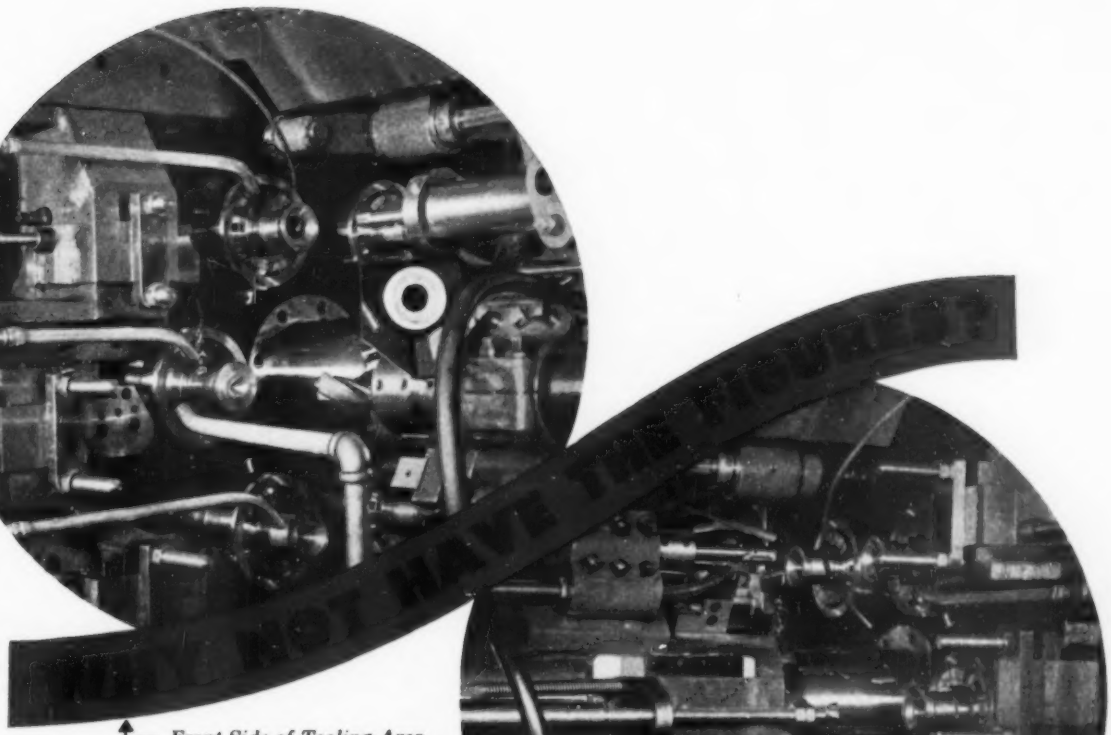
With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

WRITE FOR CATALOG

New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C-A" Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL



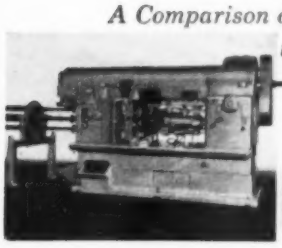
Front Side of Tooling Area
Rear Side of Tooling Area →

If you have a tough forming job in mind for a new "automatic," it's more satisfactory to know the recommended maximum load of the proposed machine's cross slides than to merely be told that they are *rugged.*

Before a machine can satisfy an important requirement it must be *built that way.* And built to figures instead of adjectives.

There are many factors involved in the building of any brand of Multiple Spindle Bar Automatic, factors on which you may want the figures. You may have the figures on CONOMATICS.

A Comparison of ALL Automatics is in Favor of Cone



In producing the alloy steel part shown, the maximum load recommendation for each main cross slide of the 3½-SIX is 8,000 foot pounds. The total net weight of the main cross slides is 825 pounds.

Conomatic} CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

THE STERLING ABRASIVES

OF THE CLEVELAND

BRANCHES . . BOSTON — CHICAGO — CLEVELAND — DETROIT —

CHUCKS and SEGMENTS SURFACE GRINDING JOBS

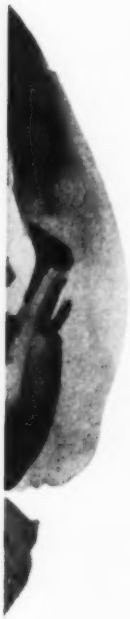
THEY ARE A PROFIT-BUILDING COMBINATION FOR TURNING OUT YOUR WORK QUICKLY AND EXPERTLY TO ACCURATE LIMITS

STERLING No. 2 Chucks and Segments do a superior surface grinding job and save you money while doing it. There is no guesswork about their value on your jobs . . . a test on the work you may be doing or planning will prove their economy and low operating cost per piece of work completed.

Sterling Segments, in proper grains, grades, bonds, and structures for your particular job, are identical in design. That is why they always fit your Sterling Chuck rigidly and firmly until released. This is also the reason worn Sterling Segments can be replaced without loss of time. Their interlocking design means added strength throughout the entire abrasive ring, and presents no dangerous projections to catch on materials being ground. The minute air space between segments guarantees cooler grinding and makes available all the cutting action of each abrasive unit.

Sterling No. 2 Chucks are not complicated and can be quickly installed on any surface grinder. Their very light weight makes them easy to handle even by apprentices, and results in unusual grinding efficiency since most of the power can be applied to grinding rather than operating the chuck.

Have you a surface grinding problem that must be quickly solved? Write us today and our engineers will bring you a quick solution.



BEST IN THE TEST – THAT'S STERLING!

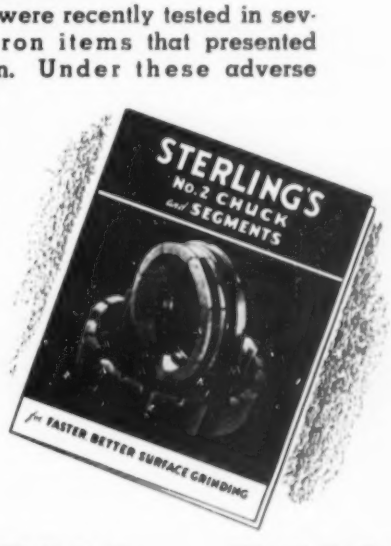
Tests are being continually conducted with Sterling Segments in all types of industries with the same result–first place and first choice!

Sterling's 18" Segments, specification PA 30 J14 VH, were recently tested in several manufacturing plants for the grinding of cast iron items that presented small areas of contact with a severe dressing action. Under these adverse conditions, Sterling Segments cut free and cool. They were preferred by all operators and produced a 412% increase in life over all other types and segment shapes tested!

On your jobs, similar results may be obtained. May we help?

Ask for these STERLING
Research and Development Folders . . .

Write for your copy of this important folder on better surface grinding. It provides complete information on the proper chucks and segments to use with various surface grinders, and gives prices which will convince you of their economy and practical application to your own surface grinding jobs. No obligation, send immediately for your copy.

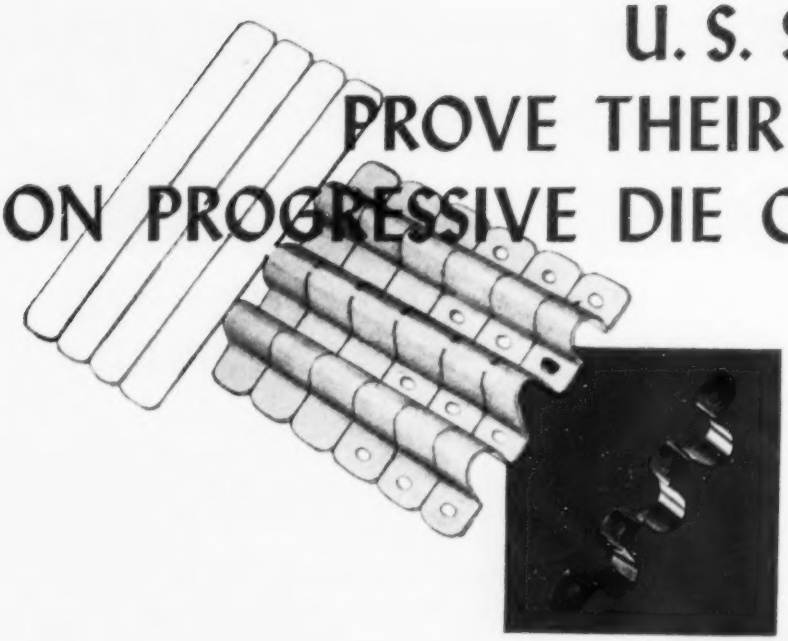


DIVISION • • TIFFIN, OHIO

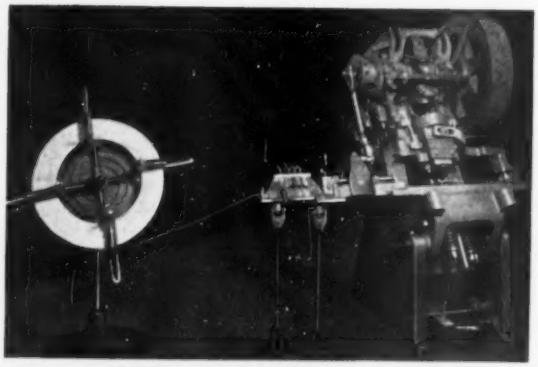
QUARRIES COMPANY

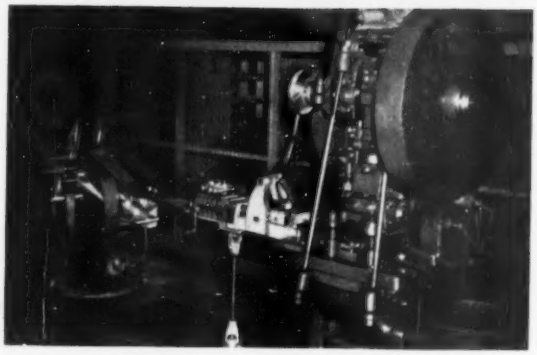
LOS ANGELES – NEW YORK – DISTRIBUTORS IN ALL PRINCIPAL CITIES

U. S. SLIDE FEEDS PROVE THEIR ACCURACY ON PROGRESSIVE DIE OPERATIONS



The photos below illustrate the use of U. S. Slide Feeds equipped with U. S. Plain Straighteners on standard type open-back presses. This setup converts the press into an automatic machine; all the operator has to do is to start a new coil of material into the die after the previous coil has been run off. To make the setup complete U.S. Stock Reels are employed in both instances for holding the coils of material.





Closely controlled accuracy with U. S. Slide Feeds—not just a statement, but a proven fact, as illustrated by the progressive die job being run by Judson & Rose, Inc., 3112 North 17th Street, Philadelphia 32, Pennsylvania.

The sketch above shows the progressive die operations. *On this job there are no stops or pilots in the die. Accuracy of feed length is controlled by the U. S. Slide Feed to closer than .001".* This example of U. S. Slide Feed accuracy is not exceptional. It is typical of results which are being obtained by other users of U. S. Slide Feeds.

If you have a press job which demands an accurate feed, we suggest that you investigate U. S. Slide Feeds. They are made in a range of sizes to accommodate stock up to 20" in width and with feed length adjustable up to a maximum of 20". Bulletin No. 80-A contains complete specifications of U. S. Stock Straighteners, U. S. Stock Reels and U. S. Coil Cradles. Ask for a copy.

® Trade Mark Registered, U.S. Patent Office

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

ease and economy

...with Super Service accuracy

● *Photo—Courtesy Aerojet—Division of The General Tire & Rubber Co.*

Working on rocket motors at Aerojet—Division of The General Tire & Rubber Company, this versatile 4′ 9″ column Cincinnati Bickford Super Service Radial is economically drilling and tapping in type 347 stainless steel.

Class 3 fit is required on the tapping operations of these ½″ x 20″ and 7/16″ x 24″ holes.

In this unusual installation a 12-foot pit permits processing of large work in vertical position, while another piece is set up on large V-block fixtures on plain box table.

The centralized controls clear view Bickford Head, and wide selection of speeds and feeds all bring ease and economy on this job.

Write for Booklet R-21-B.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio U.S.A.

Keep Your on the OLIVER Line — Cost Cutting Production Boosting MACHINE TOOLS

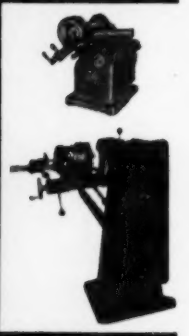
OLIVER DRILL POINTERS

Properly machine ground drills give better performance. OLIVER Drill Pointers, with each lip doing equal work, give balanced cuts—more accuracy, more perfect holes, more efficiency, longer drill life.

As Illustrated:

No. 21 Oliver Bench Drill Grinder. Hand operated for Drills No. 57 to ½".

No. 510. For Drills ¼ to 3"—2-3-4 flute.



OLIVER DIE MAKING MACHINES

Efficient, speedy and accurate — effecting great savings in time and costs. Skilled labor is not required for sawing, filing and lapping operations.

Available in 5 Models.

Bench Model S-1 (Illustrated) — Single Speed Die Maker for use on Tool Steel up to 1" Thick.

Heavy Duty Model (Illustrated) — 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

OLIVER ACE UNIVERSAL TOOL & CUTTER GRINDERS

Keep your most difficult cutters sharp with Oliver ACES. They excel on high speed and Tungsten-Carbide work. Direct reading for clearances reduces fatigue — eases operators' jobs.

The ACE excels for grinding face mills up to 15" • also, slab mills • slitting saws • all types cutters and reamers.

2 Models: Heavy Duty (Illustrated) and Standard.

OLIVER 20" TEMPLATE TOOL BIT GRINDER

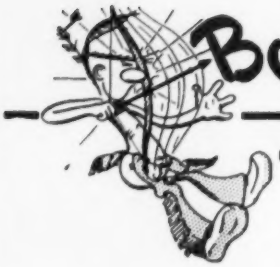
Efficiently powered by a 3 h.p. motor, this OLIVER Machine grinds on the periphery of a 20" wheel. Capacity: tools up to 1½" wide x 1¾" high, from 0° to 20° clearance. The OLIVER is developed for production sharpening of single point Tungsten Carbide and high speed tools, offers increased production, lower tool costs and savings in man-hours. Extremely fine finish assured.

Write Today For Complete Information

OLIVER INSTRUMENT CO.

1410 E. MAUMEE • ADRIAN, MICHIGAN

Backlash



EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Go West

The 1953 Production Preview (*AM*—Jan 19 '53) contains an amazing amount of data which should be welcomed by all who are responsible for plant equipment of various kinds. What impressed me most was the growing distribution of manufacturers of mechanical products. When I was an apprentice, nearly all machine tools and appliances came from New England, with Worcester having more individual builders—many of them small—than any other single city. Of course, Brown & Sharpe and Pratt & Whitney had larger plants.

When I first visited the west coast in 1914, machine shops were few and far between, with repair work the main industry, although San Francisco had its Union Iron Works and Pelton Water Wheel Co. Union built mining machinery and ships, among them the battleship *Oregon* which made the spectacular run around the Horn in 1898. As far as I know, few machine tools were then built on the west coast except the Axelson lathe, in Los Angeles, still well known in its field.

The 1953 Production Preview notes well over 100 products built in California, with a few in adjoining states. These include lathes, horizontal boring machines, milling machines, grinders, presses, welding machines, drilling and tapping machines, small tools and inspection equipment.

This indication of increasing distribution of manufacture of machine products is a good sign. It helps spread employment, instead of concentrating it in the more densely populated East. It is always a healthy sign when newer and less populated sections become less dependent on the older portions.

Fred H Colvin
Point Pleasant, NJ

Capitalist

Now the editor comes out with a revelation that plays right up my alley. He informs readers of Talking Shop (*AM*—Jan 19 '53, p289) that one non-metalworking plant is making all employees stockholders, and that results are highly satisfactory. I have always favored such a plan, and my reasons are that to convert an employee into an employer—which he would be if holding stock in the company—would eliminate all factional strife and construct a dam of

GRINETICS

BY D G SMITH

MUSIC WIRE

AUTOMATIC DRILLING MACHINE

GROUND STOCK

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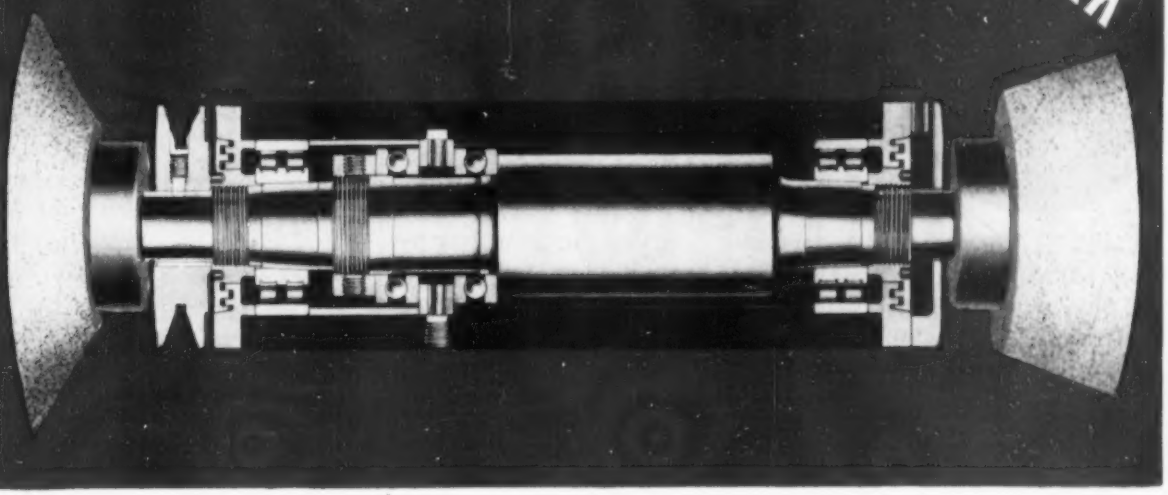
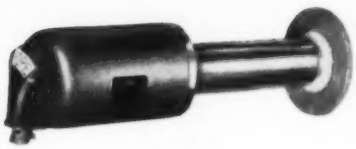
IT'S THE SPINDLE THAT DOES THE WORK





P-32T

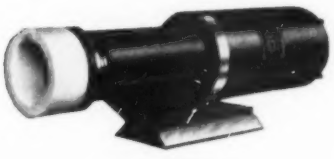
P-666

Specify POPE Precision Grinding Spindles and be certain of continuous production of finely finished parts.

Look at the pair of thrust bearings. They eliminate any endwise movement of the shaft in either direction.

Look at the double row cylindrical roller bearings. They have the rigidity to properly support the wheel for removing metal faster while producing fine surface finishes.

Lubrication — POPE System — requires no attention for the life of the bearings.



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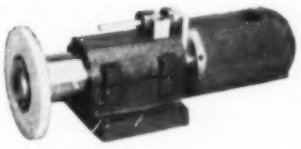

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P-2500

No. 91

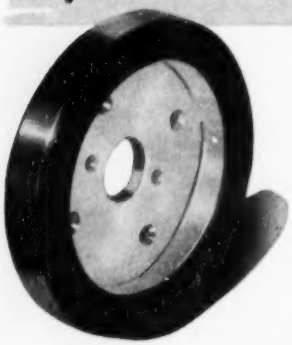
Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION

Established 1920

261 RIVER STREET — HAVERHILL, MASSACHUSETTS

Grind More Carbide *per Carat of Diamonds*

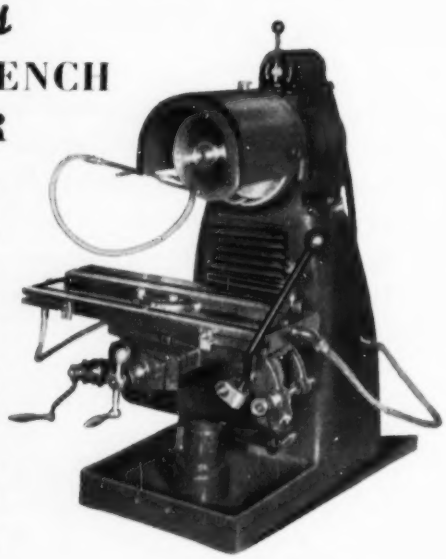


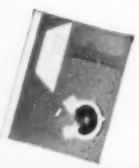
...with STEEL-BONDED DIAMOND WHEELS

Wickman-Neven Steel-Bonded Diamond Wheels stretch wheel life—lower your carbide grinding costs because they're practically indestructible. They can't be damaged even by plunging sharp-pointed tools into them. Diamonds stay in place until worn to give more cuts per carat. These wheels also give up to 300% longer carbide tool service by producing a strong, uniform cutting edge that resists breakdown.

...and this VERSATILE BENCH GRINDER

Powered with a 1 HP reversible motor, the Wickman Model GF-3 is designed especially for carbide grinding with steel-bonded wheels or chip breaker grinding. It makes carbide cut-off work with steel-bonded wheels easy, economical. Built-in coolant pump and swivel table facilitate tool grinding with metal-bonded flaring cup wheels.





For the complete story on Steel-Bonded Diamond Wheels, Resinoid-Bonded Diamond Wheels and Wickman grinders, write on your letterhead for this new 24-page catalog.

THE Wickman MANUFACTURING CO.

10325 CAPITAL AVENUE OAK PARK, DETROIT 37, MICHIGAN

effective restraint for the trouble-making agitator. It is obvious that one who is working for himself strives to put forth his best effort. It is a certainty that, were employees made stockholders in a firm, each man would be vigilant in condemning practices detrimental to the interests of the concern.

Had I purchased stock with the money I squandered on railroad fare and freight service, roaming about the country to accumulate experience after serving my apprenticeship, I might now have a pile of it to tide me over for my remaining years. But then, you can't have your cake and eat it, too. I've had a heck of a lot of fun seeing the telegraph poles flit by the train windows.

Jack Everett
San Francisco, Calif

B-r-r-r-r

I couldn't help help thinking about our shop up North, as I read "Corrugated Shop" in Talking Shop (*AM*—Jan 19 '53, p289). The happy South has no monopoly on corrugated shops, although one might be more comfortable in them—especially in winter. Can you imagine such construction on the wind-swept prairie of Alberta, where the temperature sometimes hovers around 50 below? Not only was our shop made of corrugated iron, but it was second-hand material and the nail holes made one think he was inside a giant salt shaker.

And you should have seen our heating system! We used natural gas in those bleak winter days. It was given free to induce new plants to locate in the city. We had so much of it that it bubbled from the South

Saskatchewan river, and rowing there was like rowing in a sea of Alka Seltzer. Three-quarter-inch galvanized pipe spiderwebbed the interior of the shop to reach the many galvanized cylinders, 4 ft in dia, 5 ft high, supported on three legs—sort of a stone age model of the potbellied comforter that adorned the country store.

Almost every winter in Southern California I have a feeling of homesickness as I drive by the fires of hell going full blast in the orange groves. It makes me think of dear old Alberta and the fire-belching dragons that kept us from freezing.

Incidentally, the gentlemen's rest room, a one-holer affair scientifically ventilated by unused nail holes, was specially designed to discourage undue companionship. It was located about 75 ft from the shop on the windward side. The construction was also second-hand corrugated iron, but the owner of the plant was shrewd enough not to provide gas connections for his employees' comfort. From an operations standpoint it was strictly a case of piecework, in which the worker performed without benefit of stopwatch or motion psychology, and at the conclusion of the operation he hightailed it back to the warm shop as fast as possible.

John Homewood
Ontario, Calif

No Bull

I resent John Homewood's implication (*AM*—Jan 5 '53, p86) that toolmakers are a bunch of contented cows who plod through their daily work without ambition. It is true most of us are leading happy lives. Why not? We are craftsmen who find real satisfaction in the quality of our workmanship. But that does not mean that we are not ambitious for better jobs as tool inspectors, foremen, superintendents, or managers.

We judge a man by the quality of his product, not by his ability to push someone else out of the way, and when one of our brotherhood wins to the top by reason of his ability, we feel a renewal of hope that we, too, may someday reach a similar position.

Geo Grimshaw
Pawtucket

HEAVIER CUTS IN HARDER MATERIALS AT HIGHER SPEEDS

Get More Production with GORHAM "M-40-B" Tool Bits!

Get more out of your machine tools . . . raise your production curve . . . with Gorham "M-40-B" turning tools! Use "M-40-B" wherever the application of a Super High Speed Steel is indicated, as in machining heat treated alloy steels with large amounts of stock removal at high surface speeds.

"M-40-B" is a Super Moly grade with performance characteristics comparable to those of super tungsten high speed steel. It has extremely high red hardness, high Rockwell hardness, and offers maximum toughness and abrasion resistance. You can take heavy roughing cuts with it at high surface speeds and feeds . . . use it for high speed finish cuts as well.

"M-40-B" comes in square tool bits, 11 stock sizes, and in 23 stock sizes of rectangular turning tools. Bits and turning tools are accurately ground, uniformly hardened, ready to sharpen. Special sizes and shapes to your order. Illustrated with prices are three popular size "M-40-B" tool bits. See your distributor, or send direct for a trial order.

"M-40-B" is one of three cutting tool materials developed by Gorham. Others are Gorham "Standard", for the commercial field, and "Gormet", for turning soft or abrasive stock. They're completely described, with size and price lists, in a new free bulletin. Send for your copy today.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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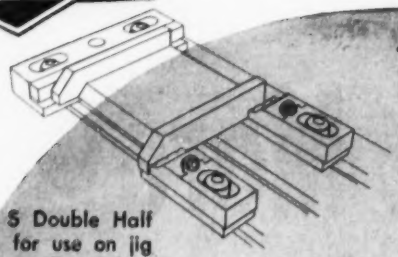
WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

J & S TOOL CO. INC.

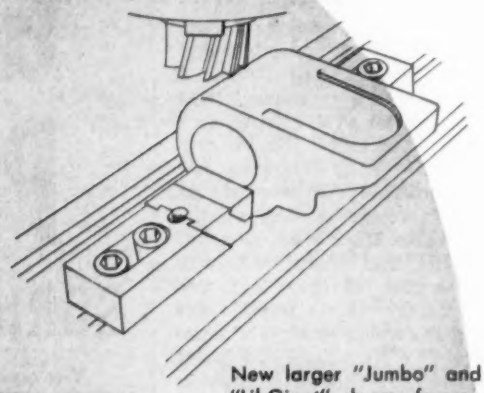
Eliminate U-Clamps, Straps and Fingers

J & S *All-Purpose* JAW CLAMPS

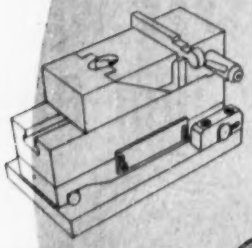
secure work-pieces quickly and rigidly
easily adapted to box fixtures

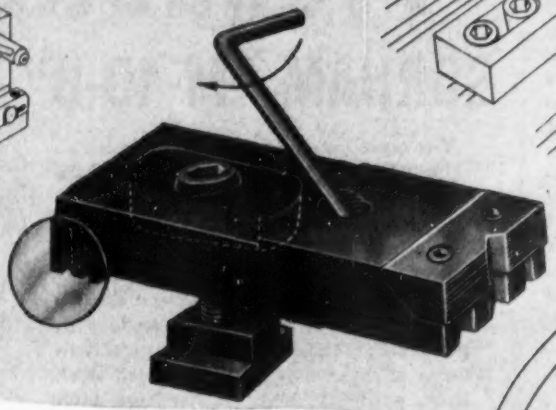


J & S Double Half Vise, for use on jig borers, millers, planers and shapers.

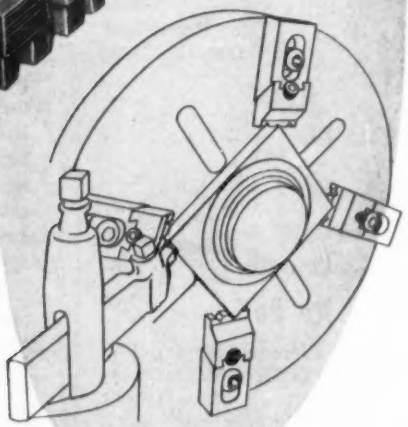


New larger "Jumbo" and "Lil-Giant" clamps for use on larger-type planers.





Precision Grinding Vise with or without sine bar allows rapid unloading and exact relocating.



Typical lathe application. Standard clamp in use.

NEW METHOD OF SECURING WORK-PIECES TO MACHINE TOOLS

for Lathes, Planers, Milling Machines, Boring Millers, Jig Borers, etc. (9 different types including new Counter Clamp)

1. **Faster Set-up:** *One adjusting screw* provides a 5-ton force to *position* and *hold the work-piece.*
2. **Stronger Grip:** The *inward* and *downward* movement of the jaw clamp at a 45° angle gives a *single, powerful clamping action* — easily applied and controlled.
3. **Less Obstruction:** You can pass over the whole clamp 1" from the working surface of the machine face. *No interference with reading or measuring tools.*

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TELEPHONE: LIVINGSTON 6-3181

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DELIVERY FROM STOCK
WRITE FOR NEW FOLDER!
—contains complete details on advantages, applications, types and sizes available.
Booklet describing J & S "Fluidmation" Wheel Dressers, etc., also sent on request.

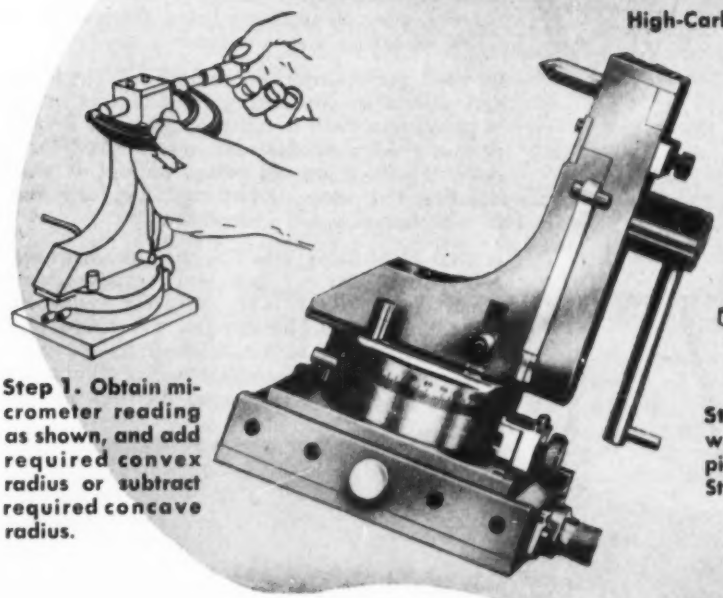
.0001" ACCURACY

eliminate elaborate set-ups and operations

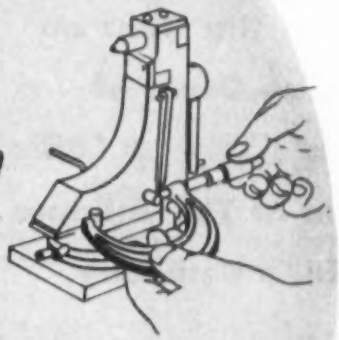
Fluidmotion WHEEL DRESSERS

dress two angles tangent to a radius in one continuous motion

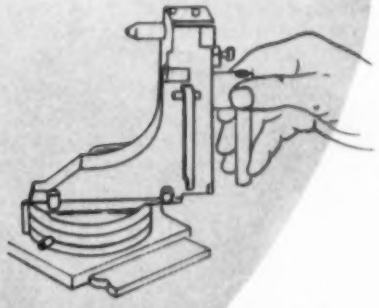
High-Carbon, High-Chrome Construction



Step 1. Obtain micrometer reading as shown, and add required convex radius or subtract required concave radius.



Step 2. Next loosen gib with wrench and "mike" over lower pins to reading obtained in Step 1.



Step 3. Tighten gib; set stops for two angles; ready for action.

ADAPTABLE TO ALL TYPES OF CYLINDRICAL AND SURFACE GRINDERS

With the "Fluidmotion" Dresser, you can *dress* two angles *tangent* to a radius—using one handle *in one continuous motion*. Operation is so fast and simple that beginners can use them to boost your grinding machine out-put. Forms are always clean, precise—angles and radii "flow" into each other. Contours are consistently sharp, accurate to .0001", without tool or chatter marks.

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New home of J & S Tool Co., Inc.

J & S TOOL CO. INC.

A variety of models and attachments to suit your needs. Write for free catalog covering dressers in detail. J & S also manufactures a complete line of All-Purpose Jaw (machine) Clamps, Vises, and Special Tools. Write for Machine Shop "Time Savers" booklet.

ELMES INCLINED FORCING PRESS
makes this tough job easy . . . and saves 50%!

Forcing the Gear on Hoisting Drum of World's Largest Ladle Crane at The Alliance Machine Company

The Alliance Machine Company, Alliance, Ohio, builder of the world's largest cranes, gives credit to the Elmes Inclined Forcing Press shown below for making possible a *50% saving* on gear installation costs.

By their performance, Elmes Inclined Forcing Presses have earned an outstanding reputation as sturdy tools of production. Built in capacities from 100 to 1000 tons, these rugged, dependable presses are ideal for forcing heavy wheels, gears and pulleys on and off shafts; for inserting and removing bushings; for many other uses in manufacturing and maintenance.

Is your plant doing jobs like these the hard way—the costly way? Why not look into the advantages of an Elmes Forcing Press? They make the tough jobs easy. Your Elmes Distributor can give you details. Write for Elmes Bulletin No. 1055-A. It illustrates and gives major specifications on the complete line of Elmes Hydraulic Forcing Presses . . . Horizontal, Vertical, and Inclined.

ELMES 500-TON INCLINED FORCING PRESS forcing a gear (9'1" diam., 10" face) on the hoisting drum of a 400-Ton Alliance Ladle Crane — world's largest. Gear weighs 8,000 lbs. Drum o.d. is 89", length 13'3", weight 33,000 lbs. Pressure of 120 tons was required to force the gear into place.

American Steel Foundries

ELMES ENGINEERING DIVISION

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

SPOT NEWS of Metalworking

- **Watch for union trend away from cost-of-living escalators** and toward emphasis on fringe benefits. This is because living-cost index has not continued to rise, and actually is below last June's level. Machinists' Union is advising its negotiators to get off escalators. Railroad unions will abandon escalators next October

- **Stamped assemblies will become even more competitive with machined-parts assemblies** as result of two developments: (1) high-speed assembling machine, and (2) high-speed machine for correcting distortion in a stamped assembly. Both types are being designed as special equipment. One assembling machine handles four different parts, one of parts being used in multiples. It is so fast it is called the "shot-gun machine."

- **Table model induction heater for heat treating small parts** and for soldering and brazing is being introduced by Swedish firm. Unit is 26 in. high, 20 in. deep, has 2 kva output.

Powdered magnetic stainless steel instead of powdered magnetic iron has eliminated difficulty in successful operation of the magnetic particle clutch, Clark Mfg Co, Cleveland, reports. Clark has applied for patents after excellent performance of 400 clutches in industry.

- **Experimental hot-air engines, made by Holland's Philips Lamps, were drafted for emergency use** as power sources for lighting and broadcasting stations during recent European flood. Engines create 180-200 watt alternating current, use 4 deciliters per hr of kerosene (but can use any fuel), are fully closed off, use no valves.

- **Rated orders no longer are necessary to secure machine tools on the so-called critical list** (Exhibit D of NPA's Order M-41). Producers of such machines, however, still must deliver 70% of their output to service users. Next all other rated orders are filled, and finally all unrated orders. For details and other machine tool news, please turn to page 121.

- **More new car models will be shifting soon to 12-volt electrical systems.** Big advantage: Marked saving in copper, which still is in tight supply.

- **A 12,000-ton forging press with 10-ft working stroke** has been installed at High Duty Alloys, Ltd., in England to make plane components. It was rebuilt from one of two presses made in World War II for producing propeller blades.

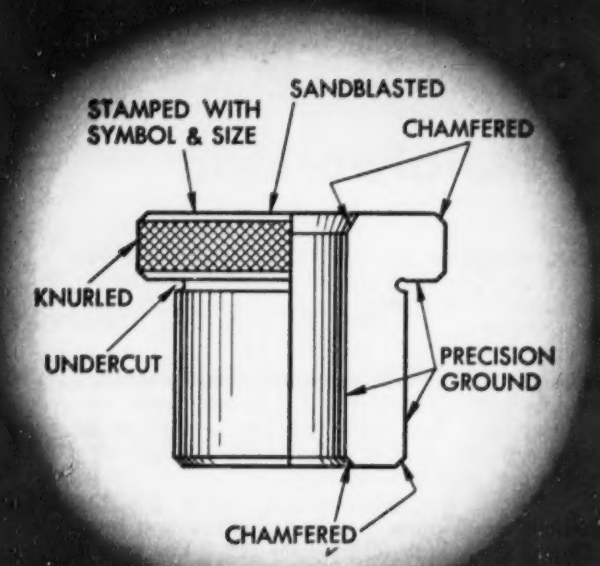
- **Instant-heating "stove lamp" with wide potential application as an industrial heat source** will soon be available to replace one heating element on an electric range. Sylvania has developed this 1500-watt, variable-heat, infra-red lamp.

Fiber glass instead of cast iron as a base for machine tools is being experimented with by a midwestern machine tool builder. This material is reported to have interesting possibilities in such applications.

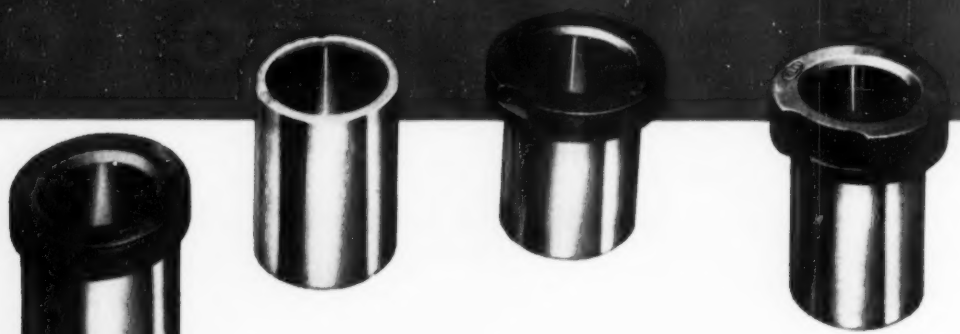
- **North American soon will have a stripped down fighter for the Air Force** to be called the Rapier. It will be largely experimental and will test the argument of speed and guns alone against armament, electronics and safety devices.

- **Government-owned machine tools in the Central Inventory in Washington** (34,000 units) are for lease only to defense-supporting industries and defense contractors and not to firms working on non-defense items. Each request for such machines is being carefully screened by NPA's Metalworking Equipment Division. Many standard tools are in such bad condition that they would have to be reconditioned to make them usable.

- **Look for Walter Reuther's negotiations with the automobile industry** as the starter of an eight postwar round of wage increases. CIO settled with Goodyear without an increase, but with wage reopening allowed on 30-days' notice.



THE INSIDE STORY OF EX-CELL-O DRILL JIG BUSHINGS



Here are a few good reasons why Ex-Cell-O Drill Jig Bushings last longer and perform better:

1. Premium grade tool steel is selected for wear resistance and heat treated to 62-64 Rockwell "C".
2. Every bushing must measure up to Ex-Cell-O precision standards, as well as to A.S.A. standards.
3. High finish is ground on inside and outside diameters, and *under the head* for perfect bearing.

Take a tip from the country's largest users of drill jig bushings. Order from the convenient Ex-Cell-O Catalog.

To satisfy the needs of your purchasing and engineering departments be sure to have an adequate supply of Ex-Cell-O Bushing Catalog, Bulletin 35371. Ask for the copies you need.

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EX-CELL-O for PRECISION

EX-CELL-O CORPORATION
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MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS
RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT
AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

51-32

Washington

Threat of stretchout of arms production may be averted as result of end of Stalin's rule in Russia. Drive to balance the budget had raised serious hopes that defense spending could be cut deeply. There had been talk that Wilson would speed up the "phasing out" of some near-obsolete items to save dollars on deliveries.

Now the brass are emphasizing, as they go to the capitol for funds, that this is no time to risk cutting into military muscle. They aren't sure yet whether the new Soviet leadership increases the threat of war. But the line they take is that we should not move to cut just in case the new gang should be more warlike than Stalin.

• • •

So, their argument is: leave the budget where it is for the present and let us work out our own economies. They point out that a re-shuffling of delivery schedules of weapons is already enabling the Pentagon to make downward revisions of its proposed spending program for fiscal 1954.

The shuffle was due to a ten percent lag in aircraft deliveries, plus a drop off of tank production. These and other factors may cut next year's spending program by as much as $2 billion—even without Congressional paring.

That kind of reasoning is bound to win over some Congressmen who already fear that economy talk may be biting into defense too deeply.

• • •

A major reorganization of government agencies is in the wind — particularly in the industrial mobilization field. Some of the plans would require new legislation, others could be accomplished by simple executive order. Here's the gist of what may happen:

The Office of Defense Mobilization would be beefed up substantially, taking over all functions of the National Security Resources Board, which has been virtually eliminated anyway. Moving into ODM would be (1) permanent but small price-wage control planning staffs—what's left of the Office of Price Stabilization and Wage Stabilization Board; (2) the remnants of the National Production Authority; and (3) the stockpile functions of the Munitions Board.

The Munitions Board would be abolished, its non-stockpiling functions being transferred to a new office of an Assistant Secretary of Defense for Supply.

• • •

Eisenhower opposition to any tax reduction this year goes beyond budget-balancing. He wants to hold back any tax cut now in order to have it available as a shot-in-the-arm to help offset a possible recession.

Business is good now and GOP economists expect it to stay good the rest of this year. A tax cut this year would be inflationary—at a time when a top priority goal of the new administration is to halt inflation.

A tax cut, they figure, may come in handy next year. By then, the Eisenhower planners feel that their budget-balancing accomplishments could have a deflationary effect that would be felt by the economy. And a tax reduction then would do them more good, especially with the 1954 elections in the offing.

• • •

Farmers' buying of machinery, equipment and consumer goods is a big question mark worrying the new administration. That's part of the cause for the big hullaballoo over skidding prices of livestock and farm crops.

One theory is that "farmers lead us into depression," hence they're worrying about farmer's spending plans.

Most experts see the farmer in good shape—despite the fact that his net income keeps dropping. But the hard facts of politics also count—which is why Secretary Benson kept up butter price supports. The powerful farm vote could easily cost the Republicans their control of Congress in the next election.

• • •

Pro-Taft-Hartley strategists are discussing a plan to keep labor law amendment within limits acceptable to Sen Taft. It worked in 1949, when the Ohio Senator pushed his 28 amendments through the Senate.

The plan is this: get coalition support in Congress early on an amendment with popular appeal, then try to hold the coalition together on future votes.

In the Senate, the test may be made on Taft's "Free Speech" amendment. In the house, it could be Rep Lucas' "State's Rights" bill restoring state laws which the courts say have been nullified by Taft-Hartley. It will be hard to fight these amendments.

• • •

Five-year labor contracts in the automobile, parts and farm equipment industries will be protected against raids by other unions under a new National Labor Relations Board policy. Reason: such contracts have become common in those industries.

NLRB announced the new rule in upholding contracts at General Motors transmission and spark plug plants, Bendix parts plant and Allis-Chalmers. It later applied the rule in denying election asked by AFL electricians at International Harvester's farm equipment plant at Milwaukee.

FOR PRECISION

PLUS PRODUCTION . . .

PRECIS-O-NIZING

OLD mass production methods are not enough to satisfy a market that is demanding both *quality* and *lower prices*.

Only through modern precision-production techniques can a manufacturer hope to use this two-edged sword to his own advantage!

Because of this need for a productive method of generating precision . . . the Microhoning process was evolved. For a quarter of a century the Micromatic Hone Corporation, working with industry, has led the honing field in the development of equipment that would productively finish parts within the ever-shrinking tolerances of new designs and standards.

This applied precision-adeptness of the Microhoning process is "PRECIS-O-NIZING".

In one economical operation Microhoning abrades stock rapidly and efficiently with a minimum of heat to generate—

—bores that are round and straight
—accurate diametric size
—a functional characterized (cross-hatch pattern) surface finish that is free of smeared or distorted material.

The processing of sewing machine parts is an example of PRECIS-O-NIZING.

Microhoning equipment is available to handle all kinds and sizes of parts . . . from soft non-ferrous metals to hardened steel and special alloys . . . from .078 to 60 inches in diameter and from ¼ inches to 75 feet in length.

MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

PRECISION PRODUCT — MICRO MATIC — TRADE MARK

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REPRESENTATIVES: Overgard Machine Tool Company, 234 Commonwealth Bldg., Denver 2, Colorado
Hallidie Machinery Co., 2726 First Ave., South Seattle, Wash. • REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

Detroit

There has been a lot of talk lately about plastic dies. One of the top people in the business had this to say the other day:

"We know they're cheaper, and we know they will stand up to the requirements. What we don't know, and what will take us time to find out, is how long they will last. In that alone will be told the story of whether it is economically justifiable to employ plastic dies.

"Right now we don't think they have an application in the big volume runs. We are not sure whether they have an application in the smaller, custom-type runs."

Plastic dies are made out of about the same material as the plastic car bodies you've been hearing about—thermosetting plastics reinforced by glass fibers.

In spite of the many worries earlier about the physical properties of plastics, that doesn't seem to be a concern in the present rash of experimental die making which is going on all across the automotive industry. One reason for this is that iron or steel inserts can be put in at hard wear or hard impact points; their insertion in the plastic die is immeasurably cheaper than building the entire form out of the metal.

• • •

With the turn into March, automobile production has gone up another notch. Weekly output figures are ranging in the neighborhood of 160,000 cars and trucks, U.S. and Canadian output combined. This is about 10,000 a weak higher than the level which prevailed earlier this year.

March passenger car projections range upwards of nearly 600,000 units; truck volume will be upwards of 125,000.

The first quarter, consequently, will not be too far away from 2 million cars and trucks. That is an all-time high for any first quarter. The second quarter will be somewhat larger—maybe by 200,000 or so. The result will be that the first half of 1953 will likely be the largest for any first half in history; the best previous mark was set in the January-June period of 1951.

• • •

To see a really beautiful production plant, tour the AC Spark Plug operations producing the Skysweeper fire control system for antiaircraft. Some 1,200 gears are required in the system, each one machined to tolerances in tenths. Some are made on special machines designed solely for those operations, costing up to $30,000 apiece for comparatively small units.

In the plant you'll see every big machine tool name you know; foreign ones too. At one point there is a battery of Oerlikon radial drills; Pratt & Whitneys were not available at the time these were needed.

Controls are tight. One cam is checked at no less than 2700 surface points for accuracy within tenths.

Some 300 suppliers deliver to AC, which in itself is a subcontractor for Sperry Gyroscope.

• • •

Nash, like everyone else in the auto business, is getting competitive. On the occasion of its press introduction of 1953 Ramblers, company officials made no bones about claiming that their styling ideas are at the head of the pack—not Studebaker's or Chevrolet's.

George W Romney, executive vice president of Nash, said his company should be given credit for building the first compact postwar sport car, and for recognizing the growing influence of sports cars in general — not Raymond W Loewy and Studebaker.

Beyond that, he said, the Chevrolet Corvette had a lot of Farina in it. (Pinin Farina is Nash's designer.)

Other Nash views: (1) It is producing the only genuine sports car in America—not "fancied-up convertibles" like Studebaker, Willys, Packard and various GM cars. (2) Nash is not over-powering its automobiles in terms of requirements for today's roads.

• • •

A U.S.-manufactured automatic transmission is currently being installed in Jaguar Mark VII sports sedans. Jaguar Cars, Ltd., the first European sports car maker to adopt fully automatic transmissions, is buying the unit from the Detroit Gear Division of Borg-Warner Corp., which also builds the transmission used by Studebaker. The transmission is available on Jaguars as optional equipment at $280.

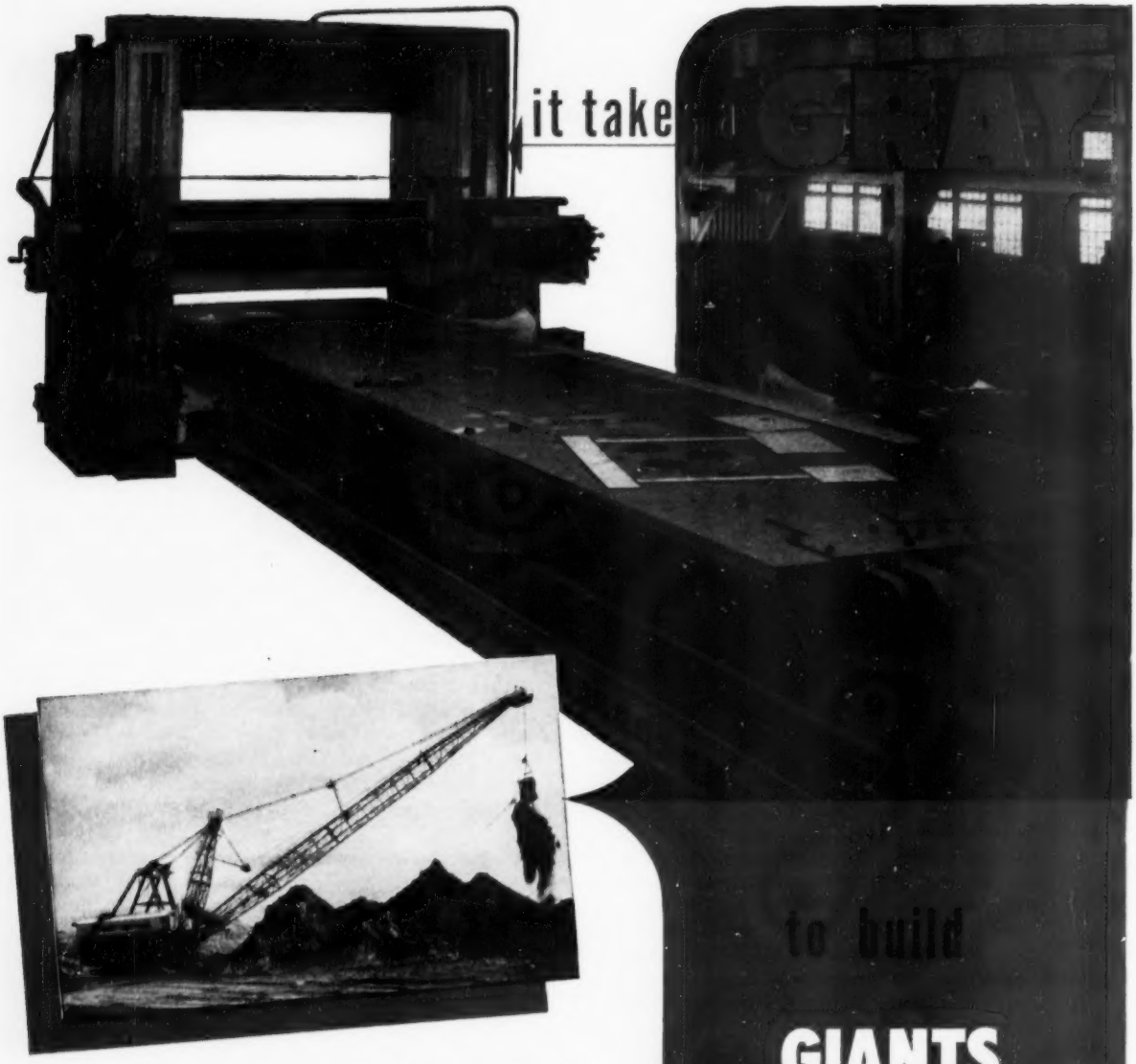
The 168-hp. Jaguar, even equipped with automatic transmission, has faster acceleration than any U.S. production car, say company officials, with the possible exception of the 1953 Lincoln, against which the "Jag" has not competed. Overall efficiency of the Jaguar automatic, B-W claims, compares favorably with a standard transmission plus an overdrive unit.

• • •

Saginaw Steering Gear Division is now tooling for a non-integrated power system. Actually, the new system functions pretty much like the present hydraulic system, except that it is somewhat of a booster system at each wheel, rather than a booster system integral with the steering column. Reason for the new development: Space under the hood is at a tighter and tighter premium, will continue to get tighter as the years go on.

Conceivably, the new system will be a little cheaper for the consumer when it is finally put into production.

it take



to build

GIANTS

that move

MOUNTAINS

Big planers are usually slow planers. But not a GRAY! Bucyrus-Erie found that out when they put a new GRAY 132" x 120" x 50' Heavy Duty Planer to work. This precision GRAY with modern high speeds and operating conveniences is machining a 55' long side section of revolving frame of a Bucyrus-Erie dragline . . . . . a big mouthful in any shop. Again, performance is proving that planer jobs don't grow old on a GRAY.

Write today • get the story on **HIGH** low cost **PRODUCTION**

The G.A. **GRAY** *Company*

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Machine Tools

Unrated orders may now be placed and delivered for machine tools on the so-called critical list (specified in Exhibit D of NPA's Order M-41).

The ban on such orders was lifted as of March 1. It was embodied in a new amendment to Order M-41.

Builders of critical machines are obligated, however, to reserve 70% of their output for the armed services. They then must take care of other rated orders, after which they may fill unrated orders.

• • •

Original plan was to eliminate the critical list (Exhibit D) altogether. But Pentagon resisted so strenuously that the list has been retained.

The effect is exactly the same, with or without the list. When a builder does not have enough military rated orders to use up 70% of his production, a larger ratio obviously will go to unrated users.

Eventually the percentage of orders for the armed services will be worked down to 60% as defense requirements are filled. At such time as the 60% level is reached, the builder will go onto the same basis for that size and type of machine as applies to machine tools in general.

• • •

Producers of non-Exhibit D machines, in other words, are required to reserve up to 60% of their output for military-rated orders.

The new M-41 amendment means that unrated orders for critical machines will begin to be delivered to customers in July. For list of critical machines, please turn to page 196.

Reasons for the change are: (1) Military and other rated customers are now getting prompt deliveries of critical machines; and (2) acceptance and filling of unrated orders will result in full and better planned production of these machines.

• • •

Backlog of all machine tools for the armed services is less than 30,000 today. That compares with 47,500 last July. It should be down to 17,000 by next July.

Rated orders of all kinds have been dropping off. Today, less than one-half of all machine tool deliveries are to rated users.

Unrated orders for machines not on the critical list have more than doubled since last August and now stand at $225 million.

• • •

More than 2000 machine tools will be shown in operation at the Third European Machine Tool Exhibition at Brussels, Belgium, September 4-13.

One hall will be reserved for exhibitors of tools, accessories and miscellaneous equipment.

Machines will be arranged by types, as they were at Hannover last year and at Paris in '51.

Over 600 builders have taken space at Brussels. Information about room reservations and travel can be had from Thomas Cook & Son or at 41 Avenue de la Toison D'Or, Brussels.

• • •

Among British exhibitors at Brussels will be: Asquith, Drummond, B.S.A., Wickman, Jones & Shipman, Webster & Bennett, Newall, Sykes, Coventry Gauge & Tool, Sheffield Twist Drill.

At last count, 29 British companies had taken space. Also, 10 US builders have signed up. Only two —Cincinnati Milling and Gleason—showed at Hannover in '52.

• • •

Some $5.6 million of war-surplus machine tools now idle in former Japanese naval arsenals are to be exported to southeast Asia on a consignment basis, according to announcement by Japanese Finance Ministry.

Most of the machines are in the Toyokawa area. Export houses in that city are to be offered 5% commission plus expenses for handling the sales.

BF

MACHINE TOOLS

SHOP TIPS

New, Free Magnet Idea Kit for Shops

A handy new literature kit showing the hows and whys of permanent magnets is currently sparking shop men to real savings in time, money, effort.

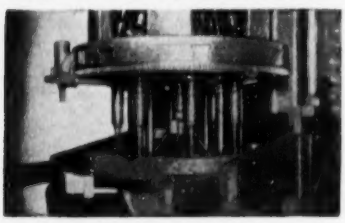
To date, the magnets have proved very effective as sheet steel separators, magnetic stands, tool-holding devices, sweepers' "pickup" tools, paper grippers and tool retrievers, to name a few uses.

Magnet Idea Kit can be obtained free from Carboloy Department of General Electric Co. (See address at right.)

★ ★ ★

Drill Cast Iron with Carbide Twist Drills

Drilling cast iron with carbide twist drills is definitely past the "maybe" stage. Users report doubled production, more than tripled drill life over



H.S.S. drills, without any special drilling equipment or job engineering. Sound, how-to-do-it technical bulletins available free. Write Carboloy Department of General Electric Co. (See address at right.)

★ ★ ★

New Masonry Drills Won't Stall, Pack

An outstanding advance in rotary drilling of masonry was recently unveiled in Carboloy oval-flute "Live-Spiral" Drills.

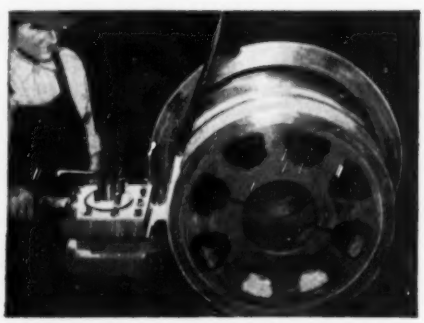
The drills, tipped with Carboloy cemented carbide, won't stall or pack even at very rapid speeds. They work equally well in concrete, brick, plaster, slate or asphalt. For full details write Carboloy Department of General Electric Company. (See address at right.)

YOUR CARBOLOY FIELD ENGINEER SAYS—

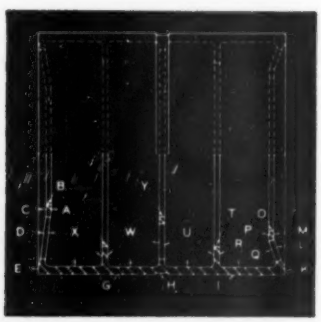
We can help you get swift tool-

Here's how one leading manufacturer quickly adapts low-cost Standard Carboloy Tools to his single-point tool machining operations – jobs that would normally require costly "specials" – and gets them on the jobs *in minutes*. No special grinding equipment. No delays or heavy inventories. By standardizing on "Standards," he gets full carbide benefits shop-wide – just as you can. Check these pages. Then send me blueprints of your tough single-point tool jobs. We'll show you how easily "Standards" can be best for you, too.

1 Gets 14 "specials" from these 4 styles of "Standards" – A large Midwestern manufacturer (name on request) needed 14 specially shaped tools for a rush job on cast steel gear blanks. From their stocks they selected the 4 Standard Carboloy Tool styles shown . . . ground them to the shapes needed in minutes per tool. No long waits for costly "specials," no extra expense or production delays. (See illustrations, below and on right-hand page.)

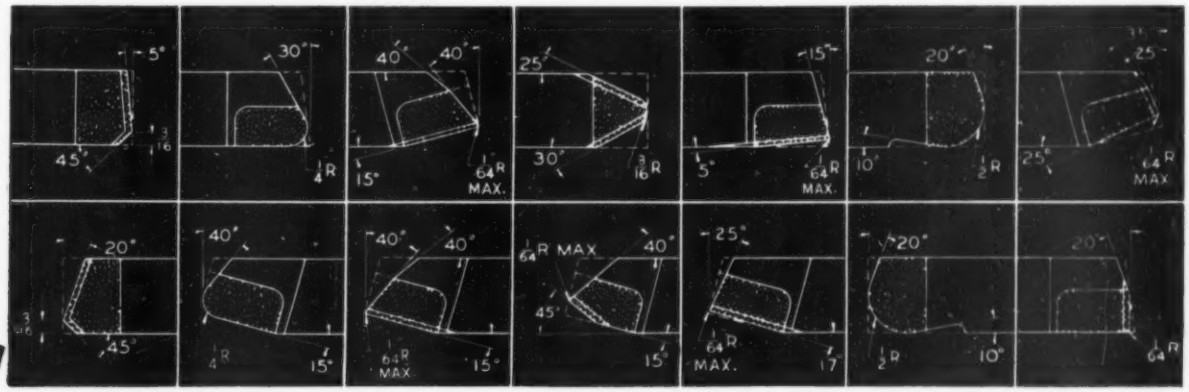


Here is the job – a tough steel casting 26" in dia., 28" wide, and requiring a wide variety of rough and finish turning, facing and boring operations.



Sketch of side view of part showing many of the single-point tool machining operations necessary for the job.

convert to Standard Carboloy Tools and ups, low inventories, lowest tool cost



Dotted lines show the original tip ends of the 4 styles of Standard Tools before they were ground to these 14 special shapes in minutes.

2 **Easy for you to use, also**—Adapting Standard Carboloy Tools to your special-tool needs is a cinch. They can be rough-ground quickly on ordinary silicon carbide wheels, finished economically on diamond wheels. Standard Carboloy Tools stay sharp up to 10 times as long as high-speed steel tools, last 10 times longer, too.

3 **You get quicker tool-ups** – You'll cut tooling delays to minutes instead of days or weeks with "Standards" on your shelves. Your inventories will be lower – costs, too. Just 11 styles of Standard Carboloy Tools can be adapted to do up to 80% of all your single-point tool machining.

4 **You enjoy plant-wide benefits** – Let us help you convert to standard styles of Carboloy Tools – for plant-wide benefits. Thousands of shops have done so . . . and now profit from such things as production gains of up to 300%, downtime savings that alone more than pay for the entire cost of the tools.

To get maximum performance from Standard Carboloy Tools, we have the industry's best all-around Carbide Service Program. Includes all types of free how-to-do-it technical data, a tuition-free training school, etc. For details, mail coupon today.

CARBOLOY TOOLS ARE STOCKED COAST TO COAST BY

AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS

Look under "Tools" in the Yellow Pages of your local telephone book, or in Thomas' Register, for address and phone number of your nearby Carboloy distributor, branch or district office.

"Carboloy" and "Live-Spiral" are registered trademarks of Carboloy Department of General Electric Company

5 **Send blueprints of your "specials"** – Let us review your single-point tool machining jobs that now require costly special tools . . . show you exactly what "Standards" can be adapted, and how. Send blueprints today to the factory at Detroit, or to your nearest Carboloy District Office. No charge or obligation. See coupon below.

MAIL COUPON TODAY!

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11149 E. 8 Mile Road, Detroit 32, Michigan

Gentlemen: Please send me, at no cost or obligation, Carboloy General Tool Catalog, GT-250.

☐ Also, I am enclosing ( ) blueprints or sketches of the single-point tools we use. Show me, free of charge, which low-cost Standard Carboloy Tools can be quickly ground to these special shapes (and how to do it).

Name _____ Position _____

Company Name _____

Address _____

City _____ Zone ____ State _____

Special Jobs are Standard with AVEY

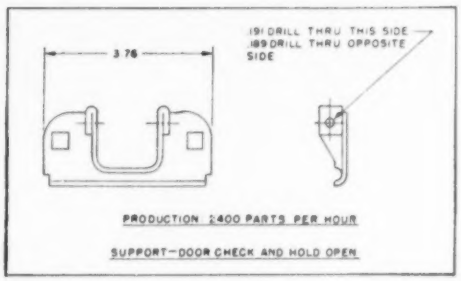
Produces 2400 Parts per Hour

SPECIAL MAGAZINE FEED DRILLING MACHINE

S. O. No. 17893—Consists of two pairs of No. 1 Avey Cam Feed Units mounted horizontally and opposed on a well designed fabricated steel base. Each pair of Units can be operated individually or collectively and each pair of Units is arranged with loading chute for magazine feed.

The parts are gravity fed down the chute to the drilling position.

Fixture—At the drilling position they are clamped automatically by an air cylinder which clamps the part on the forward stroke. The cylinder is arranged with a small ejector finger which automatically ejects part which passes into a chute in rear of machine. All clamping pressure is transmitted to the ears with final location in the square holes.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.191 DRILL THRU THIS SIDE
.189 DRILL THRU OPPOSITE SIDE
PRODUCTION 2400 PARTS PER HOUR
SUPPORT—DOOR CHECK AND HOLD OPEN

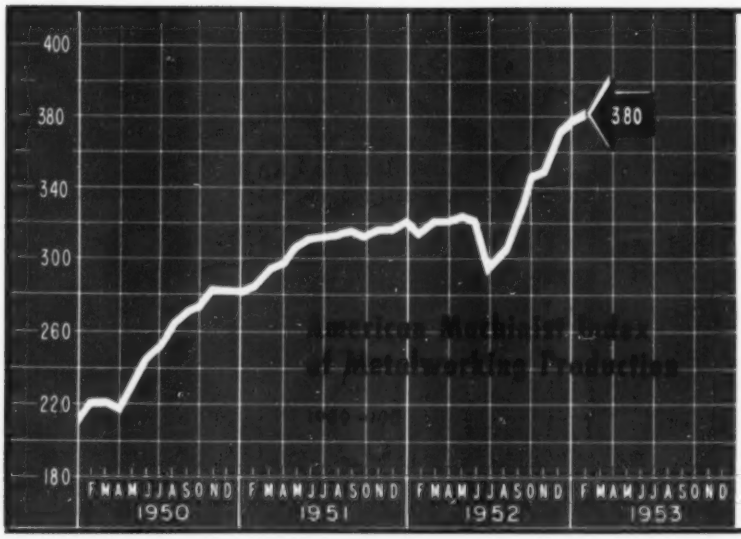
There's an *AVEY* to fit your particular job.

Consult the yellow pages in your phone book—under Machine Tools—for our nearest representative, or write direct to our factory.

SEND FOR ENGINEERING BULLETIN

Avey DRILLING MACHINE CO.
CINCINNATI 1, OHIO

Gaging Metalworking



PRODUCTION INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	FEB '53(*)	JAN '53(p)	DEC '52(r)	JAN '52
	380	**377**	**372**	**315**
Machinery	342	338	307	
Electrical Machinery	429	424	362	
Autos	296	296	217	
Other Transportation	612	592	494	
Other Metalworking	375	371	312	

(*) Estimated (p) preliminary (r) revised

Boom times will prevail in Metalworking the next few months. Indications are that operations, now at a spectacular 380 on the American Machinist Index, will stay where they are.

Incoming business is either up or holding steady. Most materials are easier to get.

Prices on end products will not rise unless prices of raw materials and labor-rate increases force upward adjustments in individual instances.

There is fear that general price advances might result in pricing goods out of the market.

Scarcity of factory labor, both skilled and unskilled, is causing concern in some Metalworking centers.

• • •

Defense production still is a major stimulant to business. It is typified by the situation in the Chicago (Army) Ordnance district.

This office was administering 1691 contracts valued at $2.2 billion at end of February. This is an increase of 233 contracts totaling $730 million during the past year.

• • •

Plane assemblies are peaking at about 1100 units a month. In terms of weight, however, plane output will increase until the third quarter.

Aircraft industry has about 20,000 planes on order. They are for delivery up through 1955.

First production of planes and engines from outside the plane industry is being felt this year.

• • •

Automobile makers are headed toward an all-time record for the first half. Their orders have greatly stepped up the tempo in parts manufacturing.

Farmers are buying tractors and other implements at a higher rate than anticipated. First quarter sales are reported up.

• • •

Expansion in automotive and home appliance fields has tightened the supply of flat-rolled sheet and strip steel.

Result is that steel mills are pretty happy over the outlook through the third quarter.

Heavy rounds, bars, plate and nickel alloys still are hard to get.

Gray iron casters believe that orders will be off only about 8% from the 1952 tonnage, which was the third best in history.

• • •

Continued heavy orders for castings from the automotive and machinery industries will keep production high for many months.

Malleable iron people report a pick-up in business, with backlogs equal to four-months' work. Steel castings demand will stay firm as long as the defense program holds up.

• • •

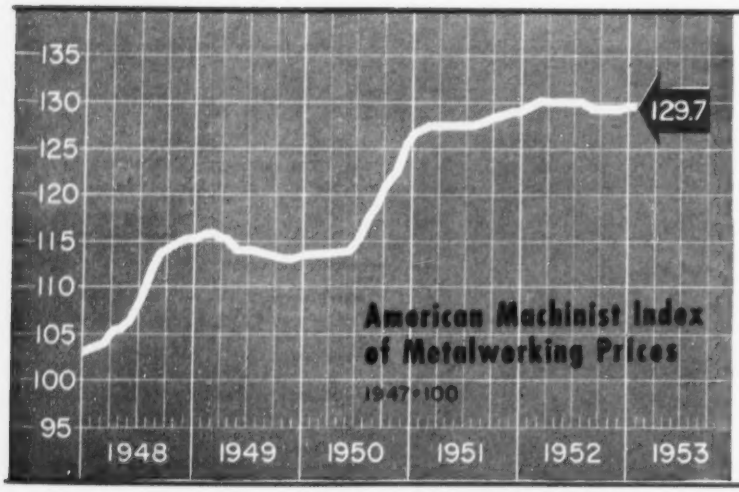
Tool and die contract shops are feeling adversely the effect of the defense stretchout. Civilian business is better but not enough to make up for the drop in armament tooling.

Freight car builders have worked off backlogs to 77,000 units, compared with 120,000 a year ago.

Production rose in January to 7981, the best showing since March 1952. Car builders still complain that they can't secure steel.

New dwelling units started in January added up to 71,000, 9% over Jan '52, 17% under Jan '51.

Gaging Business



PRICE INDEX

	FEB '53(*)	JAN '52(p)	DEC '52(r)	JAN '52
	129.7	**129.7**	**129.7**	**129.7**
Metalworking Machinery	**137.8**	**137.8**	**136.2**	
Other Machinery exc. Electrical	**132.3**	**132.3**	**132.8**	
Electrical Machinery	**124.5**	**124.5**	**126.5**	
Fabricated Metal Products	**128.2**	**128.2**	**126.7**	

(*) Estimated (p) preliminary (r) revised

Gross national product, sum total of all goods and services produced in the US, is currently running at an annual rate of about $367 billion.

This is slightly above the fourth quarter figure of $360 billion.

It is higher than early "educated guesses" had put it, the reason being a further expansion of inventories. If this trend continues, an inventory recession may be in the making.

• • •

With industrial production zooming up to a 240 level on the Federal Reserve index, the economy is in the midst of a terrific boom.

In physical output of goods, production just now is probably higher than it was at the war peak.

Everything is not on the "plus" side. Take unemployment. It was at the highest point in January in 11 months, going up more than expected.

Keep in mind, though, that normally unemployment is larger in January than in December.

Department store sales this year have not been up to those of a year ago. There have been more than seasonal declines from late 1952.

Over-all retail sales have held close to peak end-of-year volume, thanks to automotive sales.

Wholesale prices recorded little change from mid-January to mid-February. Zinc and rubber, in fact, dropped.

Copper has been the sensational performer among the metals, with prices fluctuating widely.

Consumer prices declined further the first 60 days of this year.

• • •

Contrary to seasonal trends, installment credit rose $42 million in January. It was the tenth consecutive month during which installment credit showed a gain.

Used car sales have fallen off. No one knows whether this can be taken as a forerunner to declines in new car sales.

WEEKLY BUSINESS INDICATORS

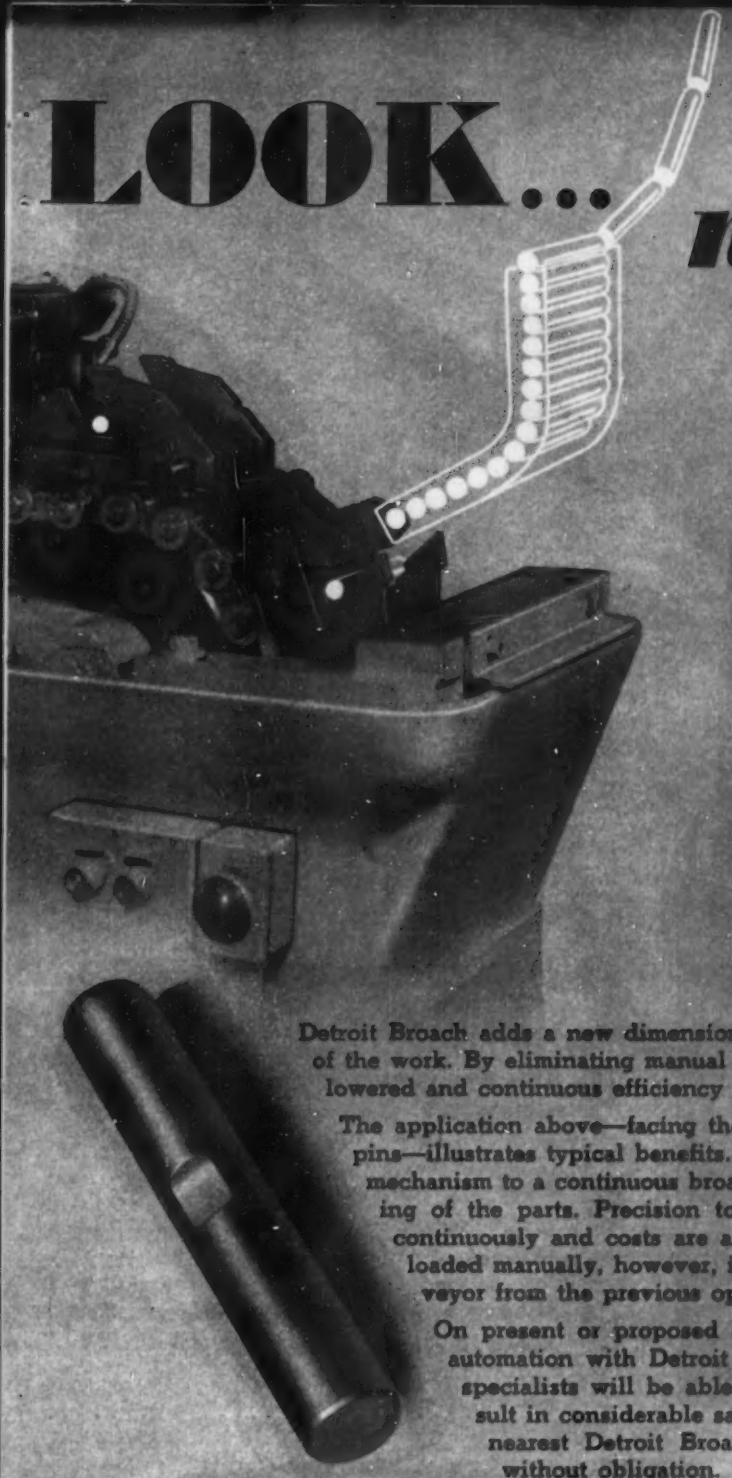
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	258.9	259.4	238.5
Steel ingot operation (thousands of tons)	2,244	2,240	2,104
Electric power output (million Kilowatt hours)	8,070	8,196	7,461
Production of automobiles and trucks	164,903	161,860	118,397
Engineering construction awards (*Eng. News-Record*—millions)	$273.7	$322.7	$296.6

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1935-1939 = 100)*	237	235	221
Index of durable manufactures production (1935-1939 = 100)*	317	314	282
Durable goods manufacturers' sales, millions*	11,952	11,676	9,745
Electrical machinery manufacturers' sales, millions*	1,303	1,238	999
Other machinery manufacturers' sales, millions*	2,004	2,060	1,863
Durable goods manufacturers' new orders, millions	11,564	11,134	10,937
Electrical machinery manufacturers' new orders, millions	1,433	1,184	1,274
Geneal machinery manufacturers' new orders, millions	1,701	1,999	2,092

* Seasonally adjusted

LOOK... *no hands!*



AUTOMATIC HANDLING *plus* CONTINUOUS BROACHING

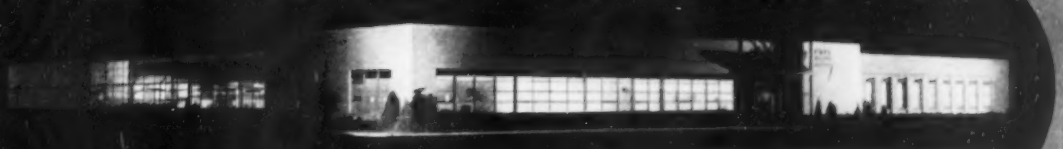
Combined to Increase Production 125%

Detroit Broach adds a new dimension in broaching economy . . . automatic handling of the work. By eliminating manual loading, production ceilings are raised, costs are lowered and continuous efficiency is assured *independent of the human element.*

The application above—facing the ends and producing a flat on automotive king pins—illustrates typical benefits. Here, Detroit Broach applied a hopper and feed mechanism to a continuous broaching machine and thus eliminated manual loading of the parts. Precision tolerances are consistently held, production runs continuously and costs are at rock bottom. In this application the hopper is loaded manually, however, in many instances the hopper can be fed by conveyor from the previous operation.

On present or proposed broaching operations it will pay you to discuss automation with Detroit Broach engineers. Chances are these broaching specialists will be able to come up with recommendations that will result in considerable savings for you. If you will just drop us a line, the nearest Detroit Broach representative will give you all the details without obligation.

WORLD'S LARGEST MANUFACTURER OF BROACHES AND BROACHING TOOLS EXCLUSIVELY



DETROIT BROACH COMPANY

20201 SHERWOOD AVE. • DETROIT 34, MICH.

NEW MURCHEY 4 IN 1 SELF-OPENING DIE HEAD

The new Murchey Self-opening Die Head is a versatile tool.

1. **Cuts machine screw threads—3/32″ to 6″**
2. **Cuts pipe threads with a receding action—1/8″ to 5″**
3. **Used as a rotating tool on automatic screw machines or drill presses**
4. **Used as a stationary tool on turret lathes and hand screw machines**

Fifteen sizes available

Write for Murchey Catalog MU-1052

Lower Cost per Thread

MURCHEY DIVISION
OF THE
MURCHEY
SHEFFIELD CORPORATION
DAYTON 1, OHIO, U.S.A.

6121

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

For Defense Purposes Only

When you mention small business in Washington, you take off your hat.

Almost every member of Congress rushes to the aid of small business. That is because David is always more popular than Goliath. It's also because there are more votes on David's side.

All of which is preliminary to saying that mistakes are made — serious mistakes — in the continual effort to give small business a break.

One of those mistakes is now in the making. It is easy to stop it before it goes farther and sets up a dangerous precedent.

The armed services own about 34,000 machine tools of various types and ages and condition of wear. They are listed in a Central Inventory and are available for rental or lease to contractors and subcontractors in defense and defense-related industries.

LATELY, small business has attempted to get hold of these machines for use in making products not even remotely connected with defense production.

The general idea seems to be that Uncle Sam has a machine-tool pool into which the little fellow should be allowed to dip at will. If he doesn't possess any capital with which to start a shop or to fill a contract, his government should provide the equipment on a rental basis.

He then is relieved of the obligation, normal to American business practice, of financing his business. The taxpayers obligingly do it for him.

This easy practice, which some Republicans as well as Democratic Congressmen are all too willing to endorse, will lead to two-fold trouble unless it is kept from getting a real start.

It is completely contrary to the traditional American concept of the separation of industry and government. It is instead a subsidy which puts Washington deep into private business.

BEYOND THAT, it puts the government into direct competition with the machine-tool industry. It was Washington's dumping of its vast holdings of machine tools that created a depression in machine tools between 1946 and 1950. The result was that the machine-tool industry came up to Korea in a sadly weakened condition.

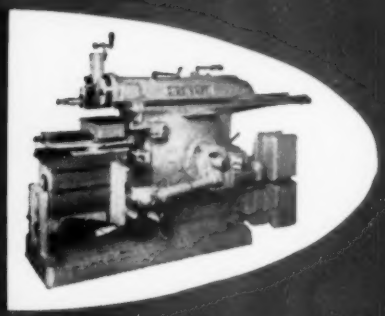
In principle, the renting or leasing of the armed services' reserves of machine tools to anyone who may want them for any production purpose at this time is akin to repeating the earlier tragic blunder. Whatever way you look at it, it is singularly devoid of merit.

More than that, it can do a lot of harm. The practice should be forbidden completely.

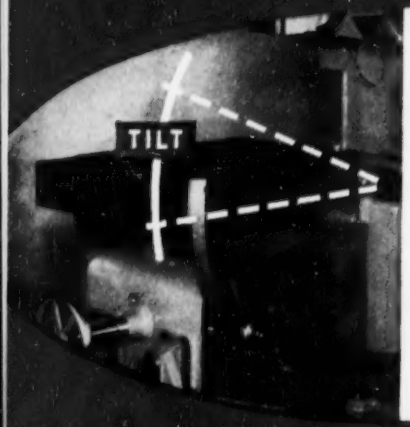
The National Production Authority has taken the firm position that the government reserves can be tapped only for defense purposes. This is a sound and meritorious position that the politicians should respect for the national good.

Burnham Finney

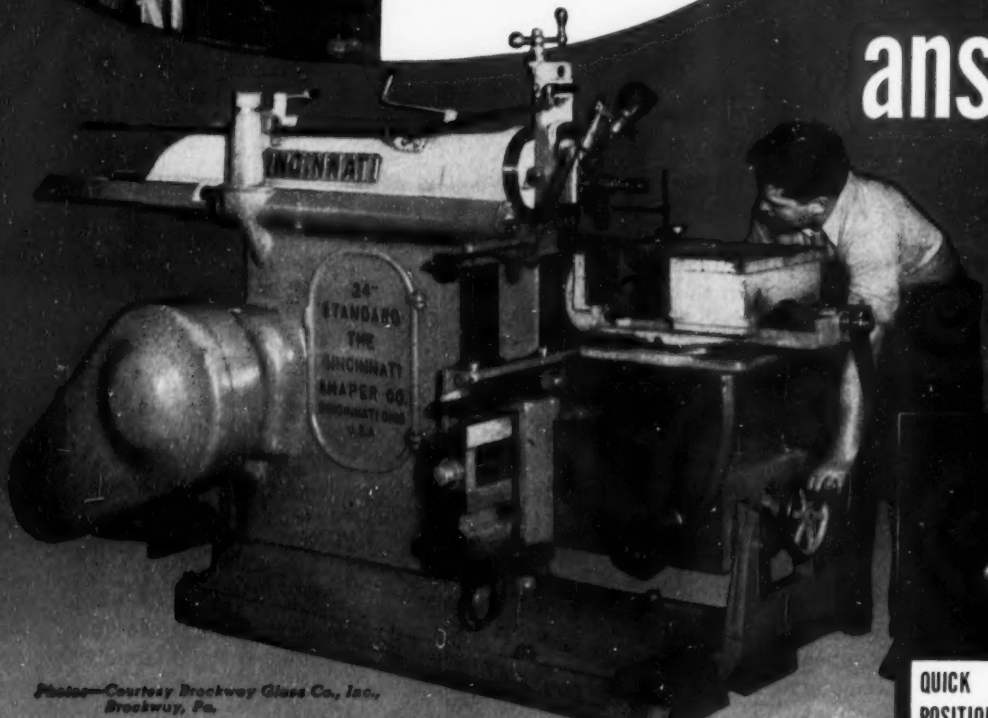
a CINCINNATI Shaper...



with tilting table...



was the answer!

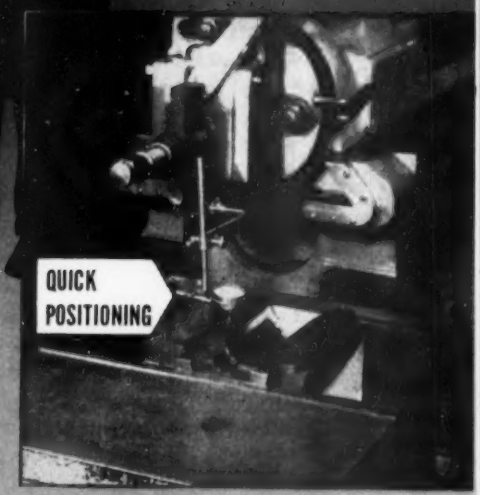


Photos—Courtesy Brockway Glass Co., Inc., Brockway, Pa.

Glass molds at the Brockway Glass Co., Inc., must be produced with very close fits on matching surfaces, and with minimum metal removal.

A Cincinnati Shaper, with special tilting table, positions the work so quickly and accurately that "flash" in molding is reduced, setup time is cut, and the useful life of molds is lengthened through the minimum metal removal.

A versatile Cincinnati Shaper, with simple fixtures, low cost tooling and accurate performance, may reduce costs in your shop.



Glass molds are quickly positioned for skim cut with the Cincinnati tilting table.

Write for Cincinnati Shaper Catalog S-6.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

By H WILLIAM GARBE,
Product Engineer, Allentown, Pa. Plant
WESTERN ELECTRIC CO, INC

One operator handles five HF-brazing setups in joining components of cathode assembly. Fixtures for brazing successive joints vary only in locating and holding details. Enclosures with clear plastic panels prevent oxygen from diffusing with the forming gas of 10% hydrogen, 90% nitrogen.

HF BRAZES HIGH-VACUUM JOINTS

MAGNETRONS are special high-vacuum electron tubes used in radar and allied fields to generate ultra-high-frequency radio waves at high peak powers. Construction of these precision instruments poses several problems in joining a variety of metals, sometimes in close proximity to glass. A production-line setup, developed by Western Electric, has proved highly successful for brazing one type of high-powered magnetron with a vacuum envelope consisting of 17 separately brazed joints. Nine of these joints are furnace-brazed in hydrogen atmosphere. The remainder are brazed with high-frequency current and consist of five cathode-assembly brazes made in a forming-gas atmosphere of 10% hydrogen and 90% nitrogen and three seal-in brazes made in an atmosphere of pure hydrogen.

Fixtures for these brazes are all equipped with similar devices for vertical and horizontal adjustments. Fixtures for the five cathode brazes have interchangeable details for holding various parts in their proper relationship for brazing. A plastic gas enclosure moves with the fixture.

Cathode-Assembly Fixtures and Equipment

Fixtures for each of the five setups are the same; only different holding and locating details are necessary. The enclosures consist of metal frames with clear plastic panels which fit snugly over the base of the fixture and are suspended with a spring balance so the enclosure can be readily removed or replaced by the operator. An enclosure is necessary with forming gas because oxygen tends to diffuse into the gas and discolor or oxidize the parts. An explosion door at the top of the enclosure dissipates pressure upwards and away from the operator in case of fire which might occur if the hydrogen concentration were increased beyond the flammable point. The whole fixture is mounted on a compound table for lateral adjustment of the work in the high-frequency work coil, the table in turn being mounted on an elevating device for vertical adjustment.

For all of this work, "Thermonic" generators are used. These are designed and built as frequency converters where electrical energy from a 220-v, 60-cps, ac line is converted into rf energy at approximately 400,000 cps. Circulation of this high-frequency current through a work transformer to the work coil at low voltage permits operations to be performed without danger to the operator. A single-turn work coil surrounds the work, its size and shape being governed by that of the work and the particular heat pattern desired. The coil induces a circulating current in the work, producing heat losses and rapid heating at the surface only. Any heat desired internally is obtained by conduction.

Each high-frequency generator furnishes power to four work transformers, and interlocking transfer switches on the primary side switch current from one work position to another. These switches are specially built for the high voltages and frequencies, and are completely boxed in and shielded for safety and to minimize radiation. They are arranged so only one position is operable at a time.

The first joint in the cathode assembly is brazing a molybdenum cone to a molybdenum cathode sleeve. Both of these parts are fairly thick, with the cone effectively shielding the cathode sleeve. The inside of the cone is coated with nickel powder and sintered, the resultant coat wetting the brazing surface and later improving the thermal balance of the structure by increasing heat conduction to the outside of the cathode assembly.

Parts to be brazed are assembled with 0.040 oxygen-free, high-conductivity copper brazing wire. OFHC copper is free from contamination for use inside this high-vacuum system, which is sealed off at a pressure of 5×10^{-6} mm of mercury or lower; moreover, the melting point of this material is constant at 1083 C.

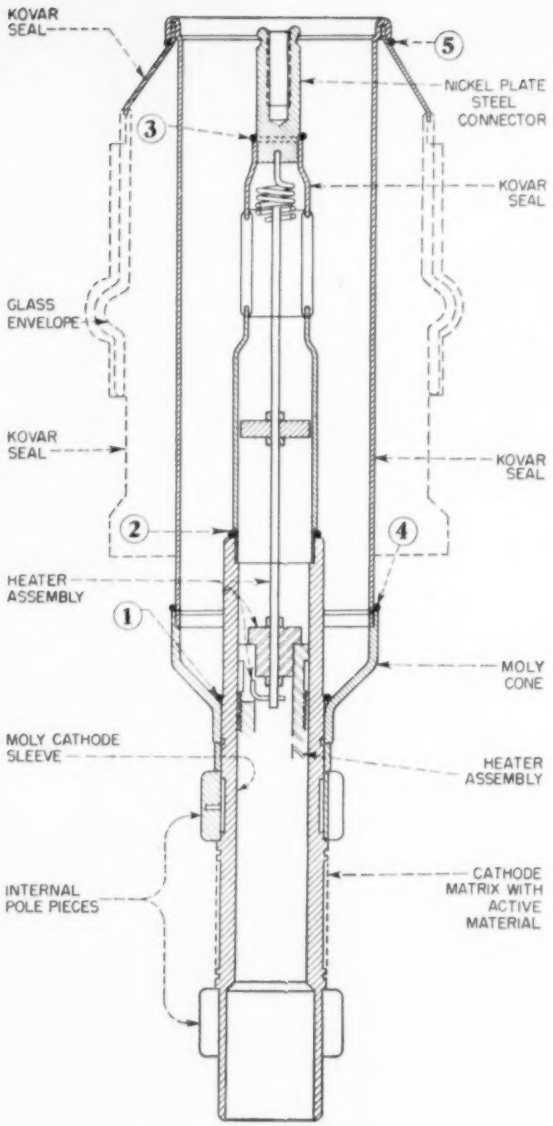
The high-frequency coupling is made to the cone only, and heat is conducted to the copper brazing ring and to the cathode sleeve by conduction. The nickel coating on the inside quickly reaches melting temperature, and the copper ring also melts from the sudden increase in heat conducted to it. Molten copper flashes up over the inside of the nickel-coated cone and runs down into the joint. Molten alloy at the joint increases conduction of the heat to the molybdenum cathode sleeve. Parts are held at this temperature until the sleeve reaches brazing temperature, and brazing alloy suddenly sinks down into the joint to form a vacuum-tight seal. The brazed assembly is allowed to cool in the forming-gas atmosphere until all redness has disappeared, then a cooling stream of pure nitrogen is flushed in. The part cools in this atmosphere until it can be handled with a gloved hand and will not oxidize at room temperature. During the purging and cooling cycles the operator can work on an adjacent setup—cycles being sufficiently long so one operator can keep five setups going.

Brazing Kovar and Molybdenum

After cone and sleeve are joined, a comparatively thin sleeve of Kovar (an iron alloy with 29% nickel and 17% cobalt, having an expansion rate similar to that of heat-resistant hard glass) and a glass envelope assembly is brazed to the end of the thick molybdenum cathode sleeve. This is done in the same fixture and enclosure but with a different arrangement of locating details. A 0.040-in.-dia OFHC copper ring is also used for this braze because of the high temperature at which it operates. Main considerations are to adjust the high-frequency coupling and soaking time so both the thick molybdenum and the much thinner Kovar get to proper temperature simultaneously. Essential and adequate flushing of the inside of the hollow parts with forming gas is accomplished with a separate hose feeding into the inside of the assembly.

Nickel and Kovar

The third high-frequency joint is to braze a solid nickel heater connector to a Kovar sleeve at the opposite end of the glass envelope assembly. Because of the dissimilar metals and radically different cross-sections, a 0.020-in.-dia solder ring consisting of 72% silver and 28% copper is used. This solder is the eutectic of silver and copper so it has no plastic state and flows quickly when the melting point of 779 C is reached. Speed is of prime importance where glass is in close proximity to the heat of the braze. Parts are held in alignment by the brazing fixture, and the heater is adjusted longitudinally within the cathode sleeve by means of an adjusting screw underneath and a dial-indicator gage and a master sleeve on top. The high-frequency coupling is fairly close so parts can be brought up to temperature quickly. The braze must be completed before heat can travel down to the glass section. Otherwise the glass would undoubtedly crack as a result of the high strains imposed.



Five vacuum-tight brazed joints are made with high-frequency current in building up this cathode assembly for a magnetron. Dissimilar metals joined in various combinations are moly, Kovar, nickel and steel. Brazes are indicated in order by the circled numerals

The cathode-support cylinder is 0.035-in.-wall Shelby seamless-steel tubing, copper-plated, then nickel-plated both outside and inside for better heat dissipation in use, and to wet the molybdenum cone during brazing. A different arrangement of details in the same fixture setup is employed, and again a one-turn work coil couples the high frequency power to the joint to be brazed vacuum-tight. The work coil is somewhat below the joint so coupling occurs mostly at the molybdenum cone for the first part of the braze. Height of the work coil is adjusted by the elevating device so both elements of the joint come up to brazing temperature simultaneously. An OFHC copper ring is again used for the brazing material because of the high operating temperature. A lengthy soaking period follows melting of the copper ring to allow the whole joint to reach the same temperature and the solder to flow down through. To insure a high-vacuum brazed joint, all solder must be molten at the same time and must be allowed to cool and solidify as a single mass. This prevents minute holes from developing through the joint and causing leaks.

Making the Last Joint

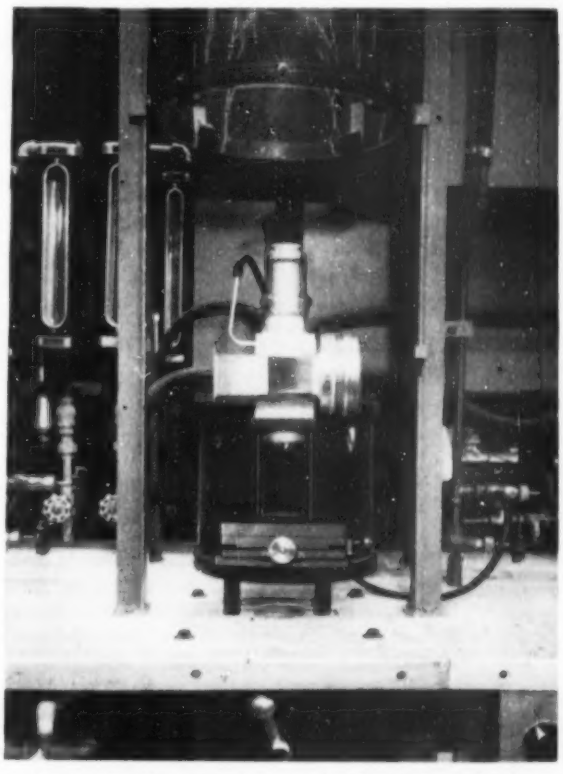
The final high-frequency operation on the cathode assembly is to braze the cathode envelope to the opposite end of the steel support cylinder. The cathode envelope is hard glass with a ring of Kovar on each end. In this braze, the joint must be strong enough to support the cathode structure in cantilever fashion, vacuum tight, and accurately located to cancel out variations in the rest of the assembly. Two 0.040-in.-dia wire solder rings of 27% silver, 28% copper alloy, are located to flow into the flange and form a puddled joint. The braze must be made quickly before heat has time to over-stress and crack the glass. The Kovar sleeve is nickel plated beforehand for protection from rust and for wetting action in brazing.

In this braze, both the outside and the inside of the assembly must be flooded with a protective atmosphere to prevent oxidization. The inside is a blind or closed pocket so it is necessary to evacuate the air with a vacuum pump, then flush it with a hydrogen-rich forming-gas mixture. Parts are accurately located in the same fixture, with details arranged diferently. The detail that locates the top of the envelope also acts as a weight so the envelope actually sinks into the flange after the solder is molten. The connection through the top of the enclosure allows the operator to rotate the cathode assembly with respect to the envelope assembly, thereby puddling the joint to break up any bubbles or capillaries while the solder is molten.

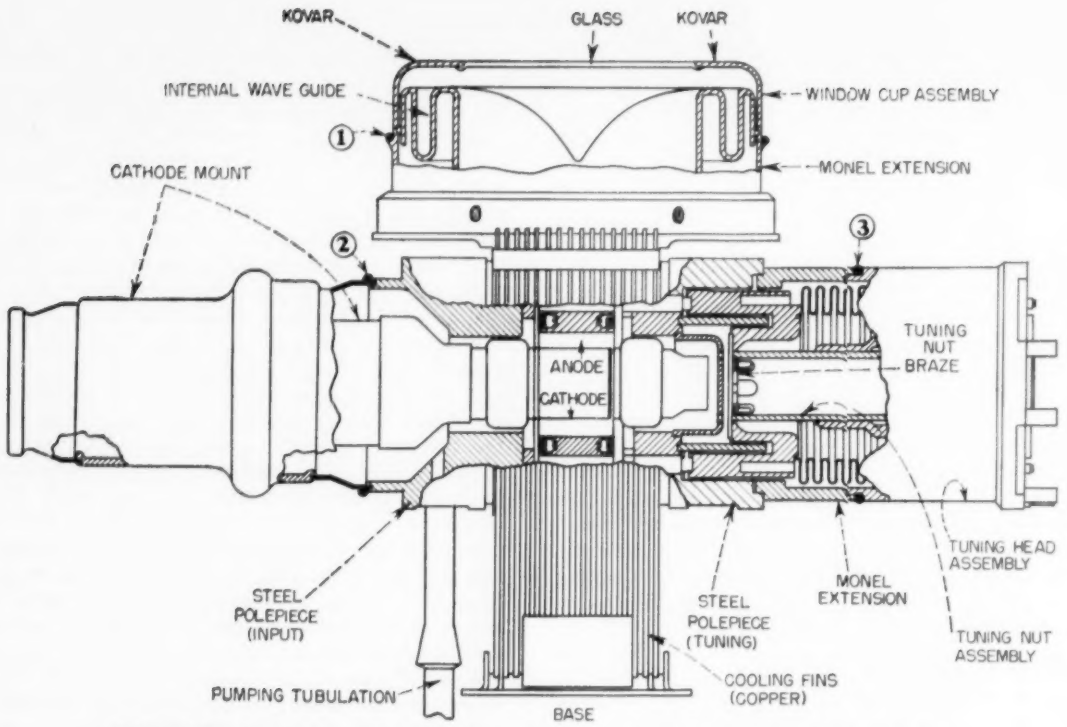
Joining Other Subassemblies

The body assembly of the magnetron is clamped and brazed in two passes through a hydrogen-atmosphere roller-hearth furnace at 800 C and 830 C respectively. Then subassemblies, such as the window cup cathode and tuning head, are brazed to the joined body with high-frequency current in a pure hydrogen atmosphere.

The window-cup assembly is a hard ground-glass lens, 2¾ in. in dia, sealed into the opening of a 4½-in.-dia Kovar cup. Because the window must withstand atmospheric pressure over 6 sq in. of surface at elevated temperatures, a very strong and strain-free seal must be obtained. The Kovar cup is first oxidized by heating it to red heat in a furnace and allowing it to cool in air. A uniform oxide coating is obtained by controlling the time and temperature accurately. The cup is then mounted in a glass-sealing fixture on three points, one a thermocouple always in contact with the metal of the cup. The ground-glass window is placed on a flat ceramic disk which can be raised to bring it in contact with the cup. A single turn, flat, work coil is coupled to the window cup with power controlled by a grid-control step switch connected to the high-frequency generator and mounted at the front edge of the bench convenient to the operator. Heat to the window cup is accurately controlled in steps by means of this switch and an interval timer, and the temperature is indicated by the thermocouple. When the cup is at the predetermined temperature, the window is raised into the hole of the cup and allowed to soak for 6 min to form a strong bond between the Kovar and the edge of the glass. After soaking, the assembly is flushed with nitrogen to cool it and to prevent further unnecessary oxidization. The as-



Compound table, mounted on an elevating device, holds fixture for brazing magnetron components. Work can be raised to optimum position relative to coil, centered or adjusted for uniform heating. Enclosure containing pure hydrogen is lowered over assembly for brazing



Subassemblies of magnetron consist of window-cup cathode, and tuning head, brazed to the body assembly with high-vacuum joints. Pure hydrogen is atmosphere for HF brazing because of its reducing characteristics. Brazes are indicated in order by the circled numbers

sembly is then annealed, cleaned and copper plated.

Brazing the Window-Cup Assembly

The window-cup assembly is brazed vacuum-tight to this Monel metal ring, previously furnace brazed to a solid copper platform with high frequency and in a pure hydrogen atmosphere using an open-mouth bell jar for safety. The bell jar is first flushed for a short interval with a flow of approximately 300 cu ft of nitrogen per hour. The two-way flushing valve is then turned to flood the bottle with 50 cu ft/hr of pure hydrogen. In case the hydrogen is accidentally ignited, it simply pops, then burns around the edges of the bottle without damage. The bottom of the bell jar is comparatively unobstructed so the gas can expand rapidly without damage.

The first step is locating the furnace-brazed magnetron body assembly on a special stand of a compound table, this in turn being mounted on an elevating device. The compound table permits fine adjustments in horizontal directions to center the work in the high-frequency work coil or to favor one side if it appears to be slower in coming up to brazing temperature. The window-cup assembly is placed on the Monel extension ring and a 72% silver, 28% copper alloy solder ring is placed around it at the joint to be brazed. A groove in the extension ring allows a puddle to be formed at the joint when the solder is molten. A water-cooled cap on top of the cup keeps the heat from traveling up the walls and cracking the glass.

The assembly is elevated into a single-turn work coil ⅛ in. larger in diameter than the flange of the joint to be brazed. The hydrogen bottle is lowered over the assembly and work coil, and after a short interval of flushing with hydrogen, high-frequency power is turned on. Both the edge of the cup and the grooved edge of the Monel extension ring must arrive at the brazing temperature at the same time. Small adjustments are made to equalize the heat all the way around by adjusting the compound table; and to get both elements up to temperature at the same time, vertical adjustments are made by the elevating device.

After the solder is molten and a puddle formed around the cup, power is turned off before the heat has reached the glass on top. The part is allowed to cool until all color has disappeared, then flushing nitrogen is turned on in place of hydrogen and the assembly allowed to cool. Nitrogen is also blown through the fins to expedite cooling.

Joining the Cathode

During the cooling cycle, which is of considerable length, the operator performs the next succeeding operation at another station. In this case, it is the cathode-assembly braze to the body and window-cup assembly. Here again, the braze must be accomplished very quickly as glass is close to the joint. The metal skirt on the cathode mount, comparatively thin Kovar, is brazed to a machined groove in the fairly heavy steel polepiece of the body assembly. Because the metals are dissimilar and of different thickness and mass, the coupling of the high-frequency current must be adjusted to compensate.

The cathode is located in the center hole of both the anode and the two polepieces of the body assembly by means of an accurately ground sleeve. The cathode is located longitudinally by previously machining the skirt of the cathode envelope to dimensions found by measuring the assembly in which it is to be brazed. The puddle is made quickly and the heat turned off before it has time to climb up to the glass in the envelope. Because it must be brought up to temperature quickly, a closed ring of solder wire is used to prevent it from springing off when the heat hits it. The solder wire is simply wrapped around the skirt of the envelope and twisted.

Seal-in-Braze

While the brazed window-cup assembly is cooling, the operator prepares to braze tuning-head assembly to the body assembly with the window cup and cathode. This braze is the seal-in or last braze before pumping. The seal-in braze is comparatively easy from a brazing standpoint, as the parts being joined are both Monel metal of approximately the same weight and thickness. There are other elements in the seal-in, however, which complicate the procedure. In the first place, the tube is enclosed, so it must be entirely evacuated and filled with hydrogen before brazing. Afterwards, all hydrogen must be pumped out and the tube refilled with air when it has cooled, to prevent explosion during succeeding operations. A vacuum line, evacuated by a mechanical vacuum pump, and a hydrogen line connected to the enclosure to be brazed through a two-way pinchcock arrangement, are employed.

In brazing the tuning head to the body assembly, it was found that to avoid fissures or grain separation in the Monel metal, it was necessary to couple the high-frequency current much closer than could be accomplished with a coil that would pass over the bracket on top of the tuning-head assembly. A work coil with a split and removable insert solved the problem. Half of the insert was removed and the work elevated into the work coil. The half insert was then replaced to provide a close coupling, bringing the parts up to brazing temperature quickly and with localized heating. Eutectic solder is again used, but it is a sleeve joint rather than the puddle joint used in the two previous brazes.

Lengthy cooling cycles permit one operator to set up and braze next joint in assembling magnetron components

Brazing Steel to Steel

Another unusual high-frequency braze is the joining of a nut to the tuning-head assembly. This braze is not part of the vacuum envelope of the tube, but is important in that it governs to a great extent the alignment of the whole tuning-head assembly. It is performed before the tuning head is brazed onto the body assembly in the seal-in braze referred to above. The tuning nut, a steel cup approximately 3 in. deep and ¾ in. in dia, threaded on the inside, is brazed to the inside of a steel closure disk. The disk had previously been furnace brazed to the pin support approximately 2 in. from the end of the 16 tuning pins so that this braze is made blind, inside the assembly. A two-turn flat work coil, offset to reach the back face of the closure disk, was employed with a thermocouple on the inside of the tuning nut and the assembly clamped into an accurate locating and alignment fixture. The heat is brought up somewhat beyond the 635 C flowpoint of the Easy-Flo silver solder used, as indicated on the thermocouple, and the part allowed to cool below the oxidizing point in a hydrogen bell jar.

After each of the joints entering into the vacuum-tight envelope of the tube is brazed, a thorough check for leaks is made by a mass-spectrometer leak detector with helium as the tracer gas. The leak detector will detect concentrations of helium as low as one part in 200,000 parts of air, which locates extremely small leaks. Leaks found in brazed joints are in general repaired in the same setup as that for the original braze. In such cases the solder in the joint must be completely melted and additional solder added if necessary, then all solder allowed to solidify as a single mass. Remelting the solder only at the pinhole or crack simply chases the leak to another location.

Cleanliness, Speed and Close Control Essential

Brazing high-vacuum joints requires cleanliness and exact control of all conditions that far surpasses the requirements for ordinary joining. Solders containing zinc, cadmium, tin, manganese or carbon (commonly found in silver solders) cannot be used. The first four elements have vapor pressures too high for the temperatures and pressures commonly encountered in high-vacuum work. Carbon has a tendency to separate out, forming pin holes and discoloration. Neither can fluxes of any kind be used, because of danger of contamination or poisoning of the active cathode.

ABRASIVE BELTS SPEED PRODUCTION CONTOUR POLISHING AND GRINDING....II

In this second of a series of articles covering off-hand, semi-automatic and fully automatic installations, Mr Olton completes his description of off-hand abrasive belt contour grinding in production. Most recent developments in various off-hand setups are described

BY DIRCK OLTON
Product Engineering Dept
BEHR-MANNING CORP
Troy, N Y

DEEP CONTOURS of marine propeller are polished by off-hand abrasive-belt method. Formed contact wheel permits polishing of complex shapes

Of the three basic types of abrasive-belt contour polishing, the off-hand method, (where a skilled operator handles the work) is the most widely employed. This type of polishing is further divided into several classes, some of which were described in the previous article, (*AM*—Mar 2, 1953). One of these processes involves the use of "free belts."

Free Belt Polishing

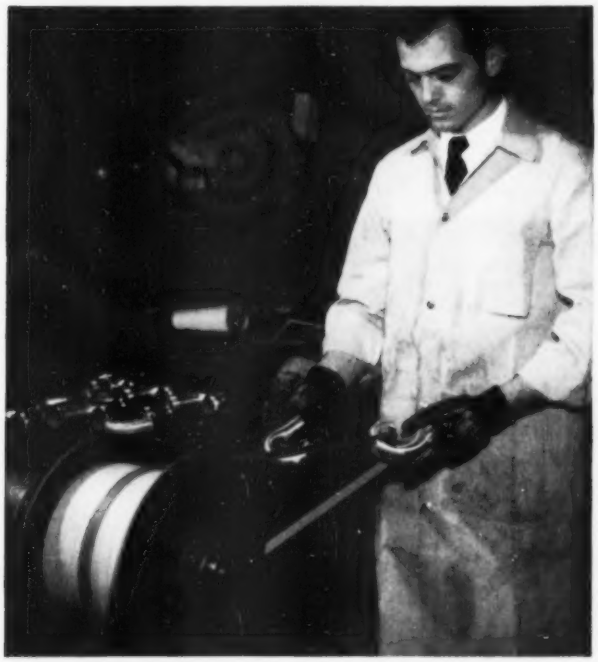
With this technique, the abrasive belt is usually driven by a flanged, rubber-covered drive pulley over an idler equipped with some tensioning device. The work is presented to the belt between the pulleys and, in the case of stepped and tapered steel golf-club shafts, is forced into the abrasive belt and positioned on two steel idler wheels. The club shaft is spun by the belt while the operator moves it back and forth under the lower loop of the coated abrasive belt.

"J-traps" in the plumbing industry are forced into such free belts; and a skilled operator, by keeping the plumbing fixture in continuous motion, blends the 180° angle of the "J-traps" into the remainder of the previously polished part.

This same operation is sometimes accomplished by using a belt that freely rotates over a flanged, rubber-covered pulley with the abrasive side of the belt contacting the pulley. The operator hooks the "J-trap" on to the belt, pulls the work toward him and the curve of the "J-trap" is then blended into the rest of the workpiece. A very clever adaptation of "free-belt" polishing is the process of deburring gear teeth. The gear is mounted on an angle fixture which moves on casters over a horizontal steel plate. The gear rotates on the fixture, being indexed by the operator, and the gear teeth are forced into the

FREE-BELT POLISHING is employed for blending contours of plumbing "J" traps. Production rates are high, finishes excellent

DEBURRING GEARS by the "free-belt" method is fast and efficient. Gear is indexed to present teeth to flexible belt which forms a radius at their ends



INTRICATE CURVES of "J" traps are also polished with loose belt that freely rotates, abrasive side down, over a rubber-covered pulley. Operator engages second part in belt as soon as first is done, thus keeping belt in constant operation

AUTO HORN RIMS are polished on "free" belts—belt life being about 100 rims per belt when 220-grit abrasive is used for zinc die castings

flexing belt to form a radius on the edges of the teeth.

Practically all horn rings for modern automobiles are polished by means of the free-belt method. The angle of the belt is carefully governed so the inner diameter of the horn ring can be finished by using the upper and lower loops of the abrasive belt at the same time.

Formed-Platen Belt Polishing

In this phase of off-hand contour belt polishing, formed platens are mounted in back of the belts. The workpiece mates in contact with the abrasive surface of the belt when it is forced into the formed platen. Normally, these platens are built either of steel or wood covered with felt or sponge rubber. This surface is covered with a graphited asbestos cloth, a waterproof glass-beaded cloth, or leather. Very often, the back of the abrasive belt is also coated with graphite. The operation is usually limited to fairly narrow belts, around 1 to 3 in. wide, and a 3-hp motor generally drives the belt at 3500 sfpm.

An adaptation of this method is found in the "tongue" sander, in which a small bearing, over which the abrasive belt operates, is mounted in the end of the tongue. A formed platen, usually made of spring steel, is mounted between the loops of the abrasive belt. The "tongue" protrudes from a horizontal surface and the work is placed over it and rotated by hand against the abrasive belt backed up

CUSHIONED PLATEN with a loose belt is employed here for producing radii on the end of a piece of glass. Sometimes platens have contours into which belt is forced for grinding contours

INSIDE CONTOURS on heavy shears are blended on "tongue" sander. Work is rotated by hand against belt and platen wheel protruding from table surface

by the platen. This process is often applied for forming the insides of rings on heavy tinsmith's shears, parachute buckles, and other similar products.

Molding-Belt Polishing

This is an old woodworking operation which in recent years has been taken over extensively by Metalworking. Here an abrasive cloth belt runs over two horizontal pulleys, one a drive. Underneath the lower loop of the belt is a table that can be moved by the operator in the horizontal and vertical planes. The workpiece is placed on the table and the operator shapes an abrasive-cloth belt into the work with a form known as a "hand block".

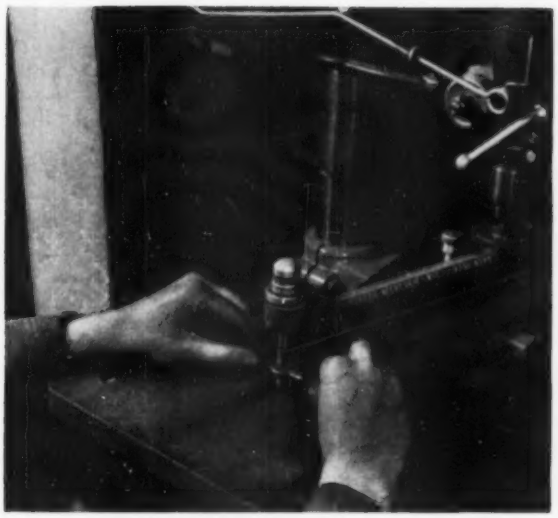
The hand block is usually made of wood or babbitt formed to fit the part to be sanded. In the case of simple shapes, after the form has been generated in the hand block, it is often covered with graphited canvas. When it is necessary to use a deeply contoured hand block, a slot is made in it to hold a piece of bandsaw steel at the bottom. The edge of the belt rides in the bottom of the slot while the hand block is forced by the operator into the contour of the workpiece.

OLD WOODWORKING TECHNIQUE is adapted in belt-polishing extruded shapes. Hand block with mating contour presses belt into surface of work

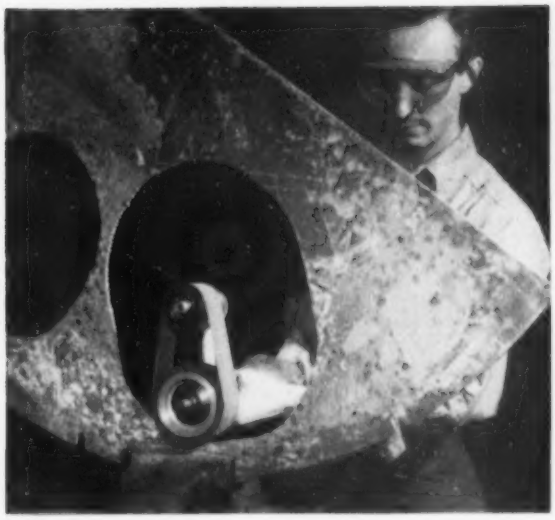
The metal-door industry, the extruded-aluminum-moldings industry, and stainless-steel fabricators have used this process to great advantage on some of their complicated polishing operations. Coated abrasive belts used in this operation normally travel at speeds from 2500 to 3500 sfpm and are quite long, anywhere from 20 to 35 ft, and are made of extremely flexible materials.

Roller-Platen Belt Polishing

This process requires the use of two cylindrical platens made of steel or combining steel with a rubber covering over which an abrasive belt operates. The workpiece is generally forced into the area between the two roll platens with the purpose of generating a radius on the part. The glass industry has used this process for many years for the edging and



SPINDLE BELT POLISHING is often required to form exact radii and to obtain specific finishes. Typical work done on vertical-spindle machine includes cutting blades of nail snips, frames of micrometers, and radii in bearing caps



PORTABLE BELT-GRINDING ATTACHMENT grinds rough edges of drilled-out hole in sheet metal and simultaneously forms a radius on the edge

"penciling" of the edges of plate glass, mirrors, and such.

The process is used by Metalworking today to polish gun barrels, tapered tubes, and to form radii on the edges of stampings.

Spindle Belt Polishing

It is often necessary to form an exact radius in a part and polish this shape to a specified finish. Vertical-spindle machines with abrasive belts revolving over a steel spindle or a steel spindle covered with rubber are used to polish a precision radius which must be maintained to exacting tolerances.

Bearing caps, the cutting blades of nail snips, and the fillets on the frames of micrometers are being polished by this means. Obviously, the small amount of wear that might be made as a coated abrasive belt passing over a steel spindle would not materially affect a desired radius as long as the tolerances were 0.010 in. or more.

Portable Belt Polishing

There might be some question as to whether or not this method should be included in the off-hand contour-polishing category. We include it because actually it represents a very important part of contour polishing that cannot be accomplished by any other method.

Large forging and drawing dies, weldments, and fabricated units such as frames and automobile bodies cannot conveniently be brought to a stationary machine to be polished. Hence, we find that the machine must be brought to the work.

For many years, pneumatic drums have been used on these operations. The pneumatic drums were covered by abrasive belts with the rubber drum being inflated until the proper cushion was obtained. These pneumatic drums have generally been used on flexible-shaft machines at speeds up to 5500 rpm.

Recently, the pneumatic drum has been built in a heavy-duty version and can now also be used as a contact wheel because of its extremely heavy construction.

Another very recent development has been the portable-belt unit which is generally operated on a high-speed air grinder at 12,000 rpm when a 2-in.-dia contact wheel is used. A speed around 9,000 rpm is employed when a 4-in.-dia wheel is used. By using soft rubber wheels or sewn muslin sections, it is possible to get a resilient action with the contact wheel which permits simple contour polishing. Another feature of this equipment is the fact that the free belt running between the drive pulley and the idler pulley can also be used to contour surfaces. Industry has become quite interested in this application of contour-polishing work that cannot be done on stationary abrasive-belt polishing equipment.

In a third article, belt polishing on semi-automatic equipment will be described.

Tips

FOR TOP SHOP MEN

453 Before you press your point of view, try to understand the opposed one. The *reason* behind the opposition may be more important than the opposition itself. It's usually more difficult to isolate, but easier to overcome—or to agree with if it's sound. After all, your point of view *can* be wrong, strange as it may seem.

454 Anticipate objections when you present a plan. Remember that the objection to a new idea usually isn't to the idea itself, but to some detail. If you're ready with the answers to the detailed objections, the idea itself will go through.

TRANSFER MACHINES working on cast-iron parts in DeSoto engine plant drop chips directly into drag-chain conveyors under machine lines. When working at planned rate of 60 "Fire-Dome" engines per hr, machine tools in this plant produce 6,805 lb of dry cast-iron chips, 142 lb of aluminum chips, and 1,523 lb of steel chips per hr. Meanwhile grinders remove 300 lb of material

CHIP HANDLING IS BIG BUSINESS

Near-automatic chip handling at this V-8 engine plant eliminates downtime and manual handling. Major details are shown here to guide others in improving this increasingly important plant service

Machining and assembly lines for DeSoto's 160-hp V-8 "Fire-Dome" engine are considered by production-wise visitors as being among the most efficient in operation today. Virtually all of the 320 machine tools in the Warren Ave plant are served by conveyors, and movement of parts and materials through shop aisles is limited to the barest possible minimum.

Planned to deliver one "Fire-Dome" engine a minute, the plant produces a lot of steel and cast-iron chips. Yet, stopping of machines for removing chips and cleaning sumps cannot be tolerated. And good safety practices do not permit manual performance of these operations while the machine tools are in use. So DeSoto's plant engineers have provided for automatic disposal of all chips, and for continuously circulating cutting-fluid systems. In no case does a machine reuse cutting fluid before it has been drained free of chips and treated to prevent bacteriological contamination.

Centralized Coolant Systems

There are four centralized cutting-fluid systems, each of which pipes cleaned and treated coolant directly to the individual machine tools and automatically delivers chips and used coolant to cleaning and treatment centers.

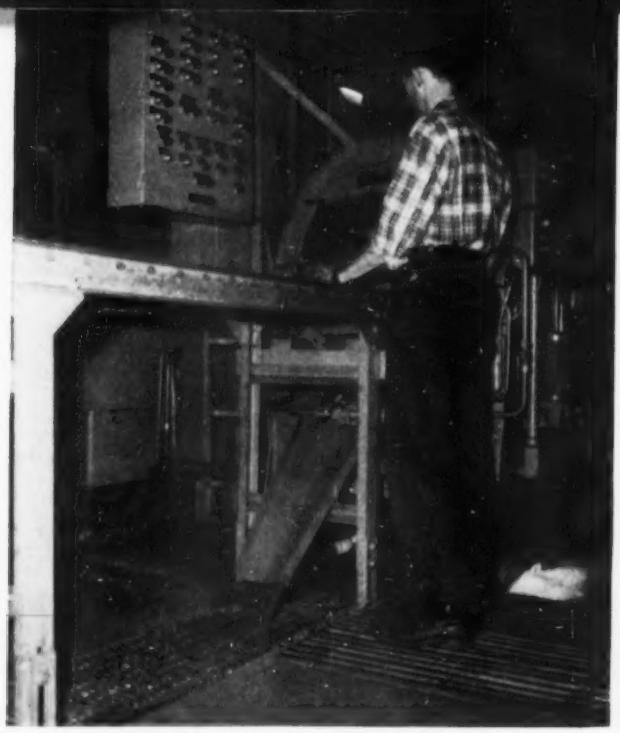
In the cast-iron machining department, the only cutting fluid used is kerosene—for fine finish boring of cylinders and for cylinder-bore honing. For these machines, a 300-gal system circulates kerosene at 140-gpm. Two fluid coolers hold kerosene temperature at 68 F.

Used kerosene drains to an under-floor settling tank equipped with a Delpark filter. Two 160-gpm, 50-ft-head pumps, alternately force kerosene through an overhead piping system for cooling and delivery to the machines.

For aluminum piston machining, a 280-gal cutting-fluid system handles soluble oil (40-to-1 mix) at 150-gpm. A Delpark filter separates chips as the coolant flushes into the drain pit from an underfloor trench paralleling the piston-machining units.

Grinders in the steel-machining department are served by an 8500-gal soluble-oil (100-to-1 mix) system through which the coolant flows at 1000 gpm. This system includes a large steel underfloor settling tank from which sludge is removed continuously by drag-chain conveyor.

A 9000-gal system through which 40-to-1 mix soluble-oil coolant is pumped at 2500 gpm serves three lines of turning, milling, and drilling machines in the steel-machining department. This system drains to a large underfloor



CHUTES TO GRIDS covering conveyor trench are provided wherever chips may fall from parts in cast-iron machining department. Setup at block turnover fixture, above, is typical. Production workers do no chip handling

HEAVY STEEL GRATINGS cover conveyor trenches. Trucks can operate across them, yet conveyors are readily accessible for inspection or repair

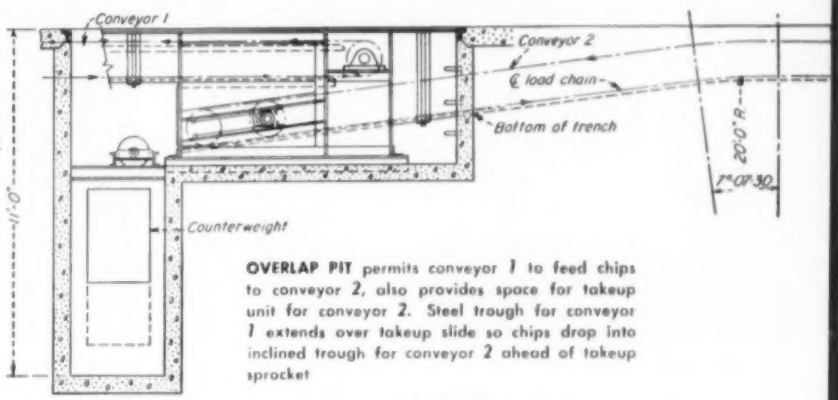
AT DESOTO

BY BEN C BROSHEER, ASSOCIATE EDITOR

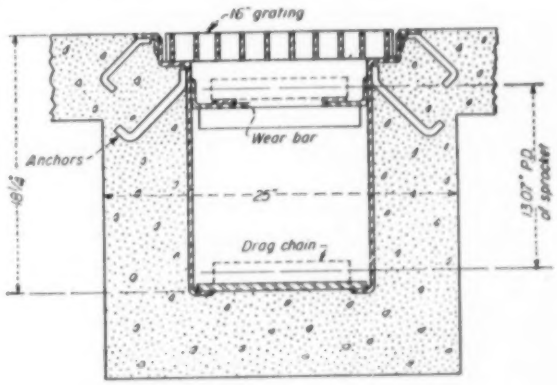
steel settling tank equipped with the novel chip conveyor shown. Cutting fluid is returned from a strainer pit to overhead supply lines.

In the steel and aluminum machining departments, chips and cutting fluid fall from machining and grinding areas in the machine tools directly into underfloor trenches sloped to drain to their respective sumps. Flow in each trench is approx 8 ft per sec, which was proven by tests to be more than adequate to carry all chips into the pits.

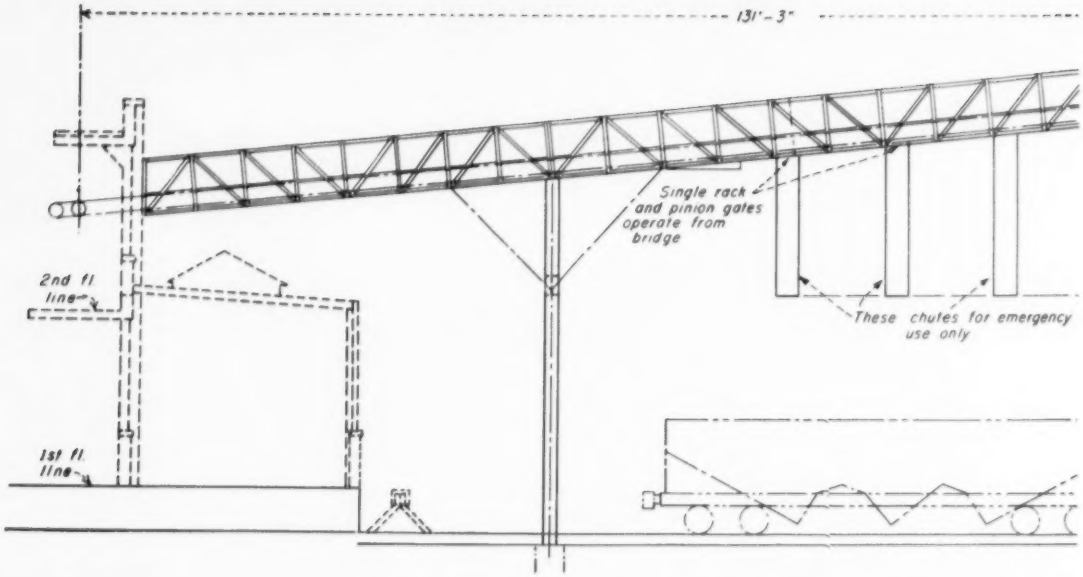
Before return to the machine tools through overhead piping, the soluble oil cutting fluid in each of the three systems in the steel machining department is thoroughly aerated and filtered. Makeup soluble oil is stored in a 12,500-gal outdoor tank at one end of the engine building.

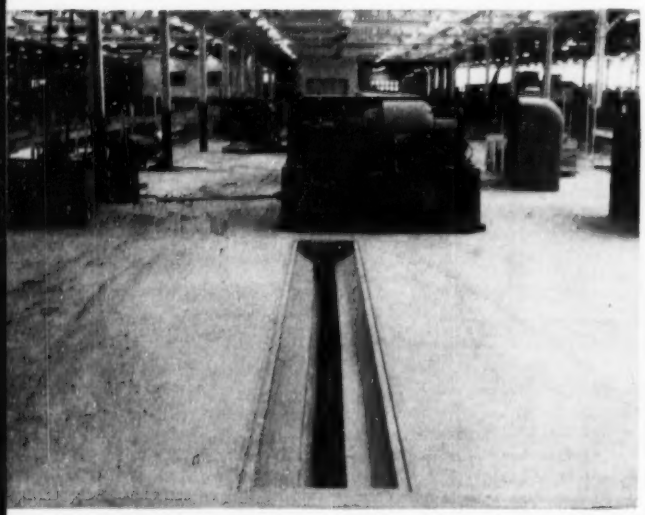


OVERLAP PIT permits conveyor *1* to feed chips to conveyor *2*, also provides space for takeup unit for conveyor *2*. Steel trough for conveyor *1* extends over takeup slide so chips drop into inclined trough for conveyor *2* ahead of takeup sprocket

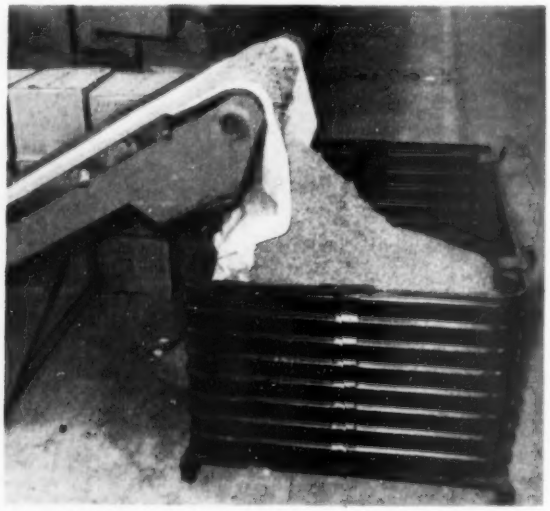


CHIP-COLLECTING CONVEYORS in cast-iron department use Link-Belt H-102 (5-in. pitch, 9¾ in. wide) cast chain in steel-lined trenches. Chips fall through upper chain-run and are pushed along 12-in. wide, ½-in. thick wear plate in bottom of trench

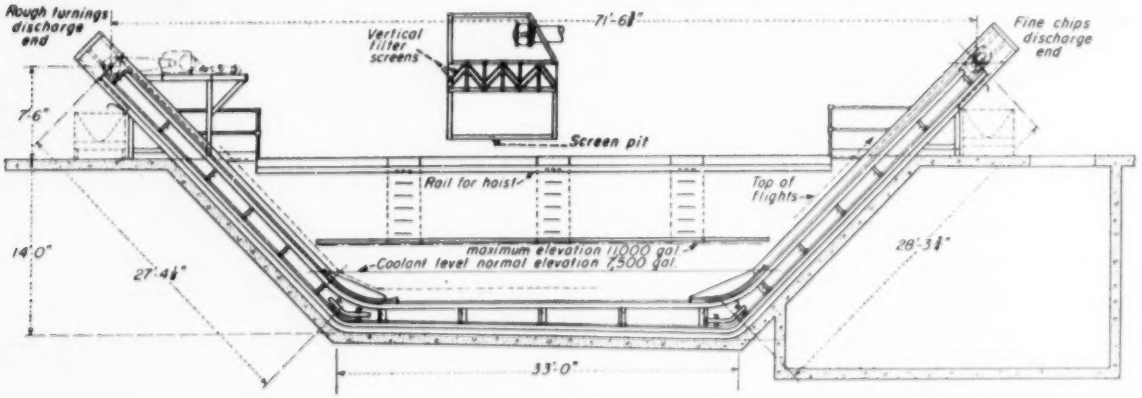


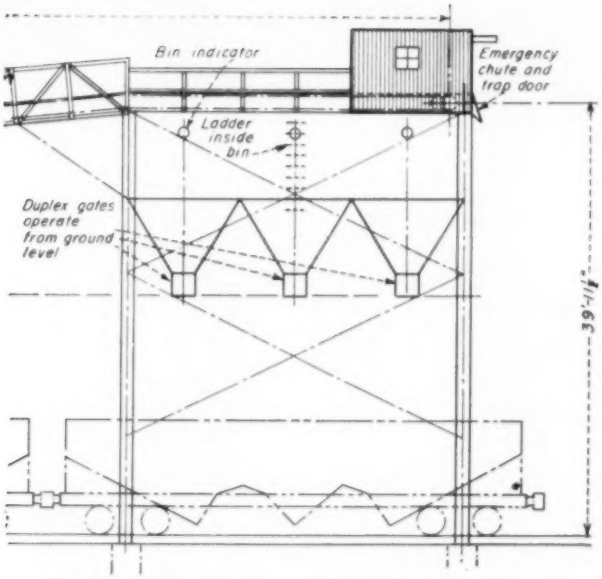


CUTTING-FLUID TRENCHES are open under the machine tools they serve. Chips drop directly into trench from workareas. Bottom of trench is formed to suit 4-in. dia pipe employed where trench must be bridged as shown. Usually trenches are open for full length and are covered with steel floorplates

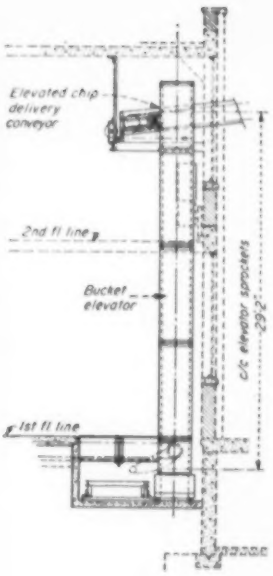


DISPOSABLE WEB carrying aluminum chips from Delpark filter serving piston-machining group is fed into lift bin for transfer to scrap-accumulation center in yard. Filter handles nearly 142 lb of chips and 9,000 gal of soluble-oil coolant per hour when plant is operating at planned capacity

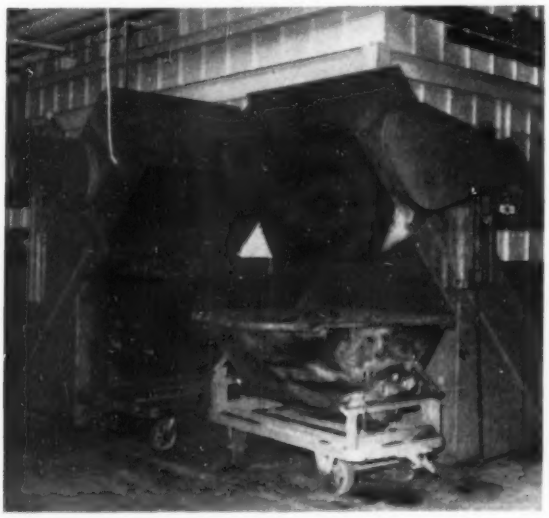




CHIP ELEVATOR has V-buckets suspended from heavy-duty steel roller chain. Elevator raises cast-iron chips 30 ft and dumps them into high-level drag-chain conveyor indicated in large drawing at far left

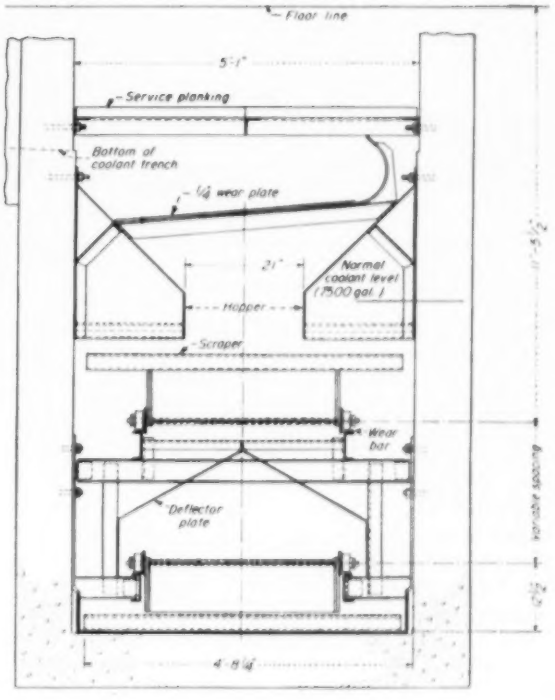


HIGH-LEVEL DRAG-CHAIN CONVEYOR carries chips to 200-ton capacity outdoor storage bin. Chips are dumped when full gondola load has been accumulated. Emergency chutes dump directly to gondola should conditions make it desirable to bypass bin. "Bindicators" showing chip level in bin compartments are connected to electric signal lights on conveyor-control switchboard



SCRAPER CONVEYORS move grinding sludge from coolant settling tank (right) and fine chips and sludge from steel-turnings settling tank (left). Larger steel chips are delivered by same conveyor to truck at other end of tank (not shown). Self-dumping trucks are moved by tractor to outdoor scrap-accumulation area

COMBINATION APRON AND SCRAPER CONVEYOR delivers rough steel chips to left end of coolant-settling tank, and fine steel chips and sludge to right-hand end. Tank has normal capacity of 7,500 gal, max capacity of 11,000 gal. Screen pit beside tank (see detail) has double row of vertical filter screens to clean coolant flowing out of tank. Adjustable-speed drive moves conveyor at 0.94 to 4.7 fpm. Conveyor is supported by two heavy-duty chains spaced on 3-ft centers, and has scraper flights spaced at 4-ft intervals



STEEL-CHIP TANK has baffle plates, where coolant spreads out and looses velocity. It then drops through hoppers directly into apron-conveyor compartments. Here large turnings and chips are lost as coolant turns upwards and flows out over edge of apron. Fines and small chips are carried out of conveyor by flowing coolant, then settle to bottom of tank. Return run of conveyor with scraper flights moves them to end of tank for discharge. Meanwhile same conveyor has delivered larger chips to truck at other end of tank

INDUCTION HEATER, rated at 50 kw, is capable of heating a section of camshaft in 4.3 sec for case hardening. Such a unit may emit strong radio signals

What to do about certifying your induction heater

If your induction heater was made before 1947, you can't use it after June 30 without FCC certification. Here are some simple steps you can take to prevent radiation

By OTTMAR NOESKE, Electronics Section ALLIS-CHALMERS MFG CO, MILWAUKEE

Industry's induction and dielectric heating equipment is now the subject of scrutiny in the light of the recently issued Federal Communications Commission Regulation No. 18. As recently amended, these rules require certification on or before June 30, 1953, of all equipment installed or manufactured prior to July 1, 1947.

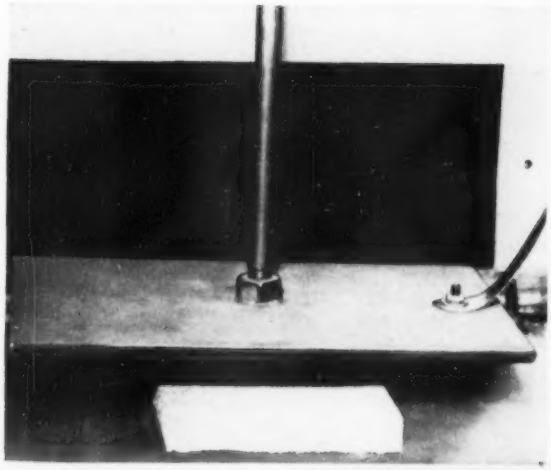
This date is rapidly approaching, and users of uncertified equipment have little remaining time to comply with the Commission's rules. The rules, as set forth, govern the assigned frequencies of operation with allowable frequency tolerance and radiation. The certification requirements are clear and concise; nevertheless, users of industrial heating equipment have questions regarding the elimination of radiation and interference.

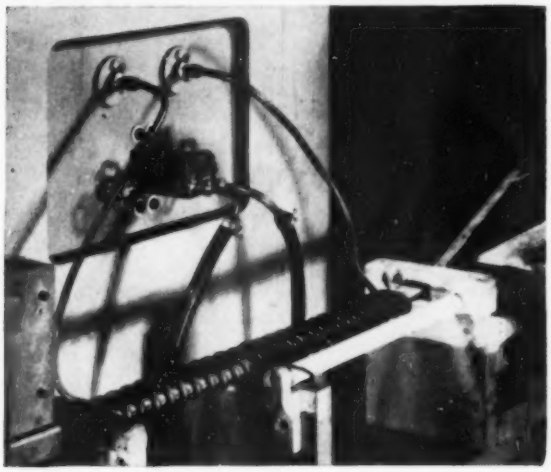
Manufacturers of electronic heating equipment are required to meet FCC certification regulations on new units now being supplied. Some suppliers offer assistance to their customers in obtaining certification of units built before the regulation was issued. In general, with only a few modifications and some caution, most earlier installations can be readily certified. Recommendations and services are available from consulting engineers and manufacturers regarding adequate shielding of this equipment.

Why Certify?

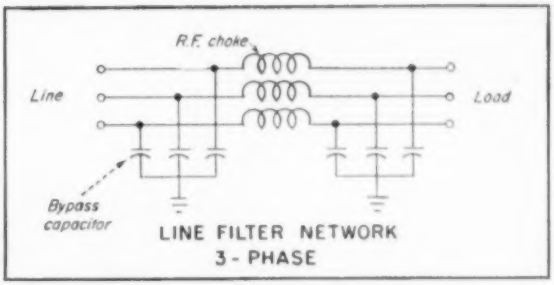
The many hundreds of electronic heaters that have been installed since World War II are presently producing radio signals which are picked up by FCC monitoring stations. These signals can interfere with communication activities, police channels, aircraft operational channels, radio, and television, making it virtually impossible for the government monitoring service to keep a close check on unauthorized communication activities. Signals originating from an industrial installation are not necessarily limited to the local area in which the equipment is operating. Often signals picked up on the West Coast are traced to installations operating in the Midwest, as at Detroit or Cleveland.

After studying the problem extensively, the FCC

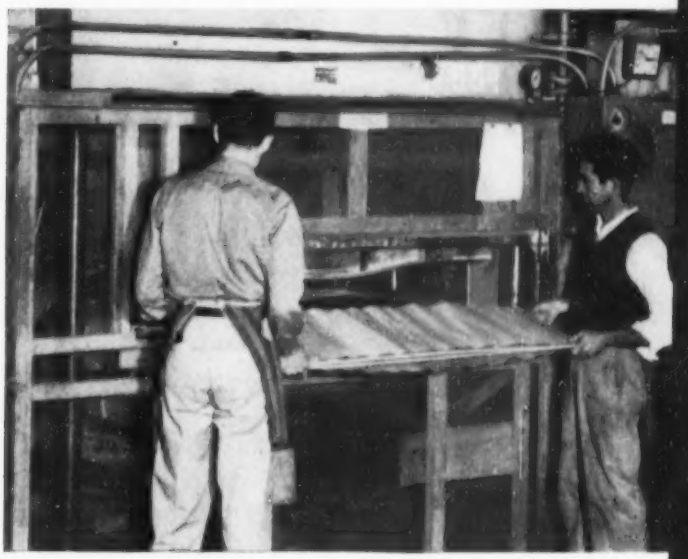




UNSHIELDED ELECTRODE (upper) and multiple-turn work coil (lower) used respectively for dielectric and induction heating are common sources of radiation



SIMPLE FILTER NETWORK is now installed in most heater cubicles. It can be made up with standard radio components and will prevent radiation into power lines



SIMPLE CAGE ARRANGEMENT used in wood gluing operation encloses the heating zone during the heating cycle but can be opened easily for loading and unloading

issued a set of regulations which were enacted in 1947. These also cover scientific and medical services but, to metalworking executives, the portion applying to industrial equipment is of most concern.

The Commission rules and regulations allow an industrial electronic heater to operate without a license (required by all transmitting stations), provided certain conditions are met. The operating frequency can be held within a specified frequency limit or band, which is set aside for industrial use, or the apparatus can be shielded so maximum radiation at any frequency does not exceed 10 microvolts per meter at 1 mile from the installation and measured at a height of 12 ft above ground. The rules also specify that radiating signals traveling along a power line must not be stronger than 10 microvolts per meter at 1 mile from the installation and 50 ft from the power line.

The design of the equipment and the particular application usually rules out the specification of operation within a designated frequency band. This means that, in most cases, the equipment must be shielded to conform with the present regulations.

It is the responsibility of the user to see that his equipment is certified to conform with FCC regulations. Failure to do so may result in a notice that the equipment must cease operating until it is made to conform. In writing the regulations, the Commission has taken into consideration the fact that many units were already operating in the field. In these cases some time would be required to rework and certify them to bring them within the limits of radiation.

What Causes Radiation?

In general, electronic radiation might be broken down into three categories:

1. Radiation from within the heater cubicle.
2. Radiation from the electrodes or coils.
3. Radio-frequency feedback to input power lines, causing radiation resulting from the power lines carrying these high-frequency signals.

The latter, radiation from power lines, is usually the easiest to control. At present many manufac-

COPPER BONDING STRIPS or ordinary copper weatherstripping will make effective electrical contact between access doors and the body of the cabinet

CONVEYORIZED CORE OVEN has tunnels at entrance and exit to act as wave traps. Work can pass through heating zone uninterrupted, without equipment radiating signals strong enough to exceed specifications

turers are taking care of this problem with a filter network within the heater cubicle, as shown in an accompanying illustration. For users of older equipment this filter can be fabricated easily, using standard components readily available from the radio industry.

Most up-to-date equipment is constructed in radio-frequency-shielded cubicles and, with proper maintenance, these will remain shielded indefinitely. If a user has an early model of an induction or dielectric heater housed in a nonmetallic cabinet, he may either replace the equipment with a more recent design or build an RF-tight metallic cubicle or screened room. If a metallic cubicle is used but radiation from it still exists, here are some helpful hints based on cases where noninterfering radiation existed:

1. If the heater contains access doors or panels which do not close properly to make a good electrical contact to the cabinet itself, the addition of copper weatherstripping or copper bonding strips, will help correct the difficulty.

2. If the heater cubicle contains a window or opening which is not covered with screening, it is possible that radiation is being emitted from there. Copper mesh soldered to cover the window or opening will provide adequate shielding.

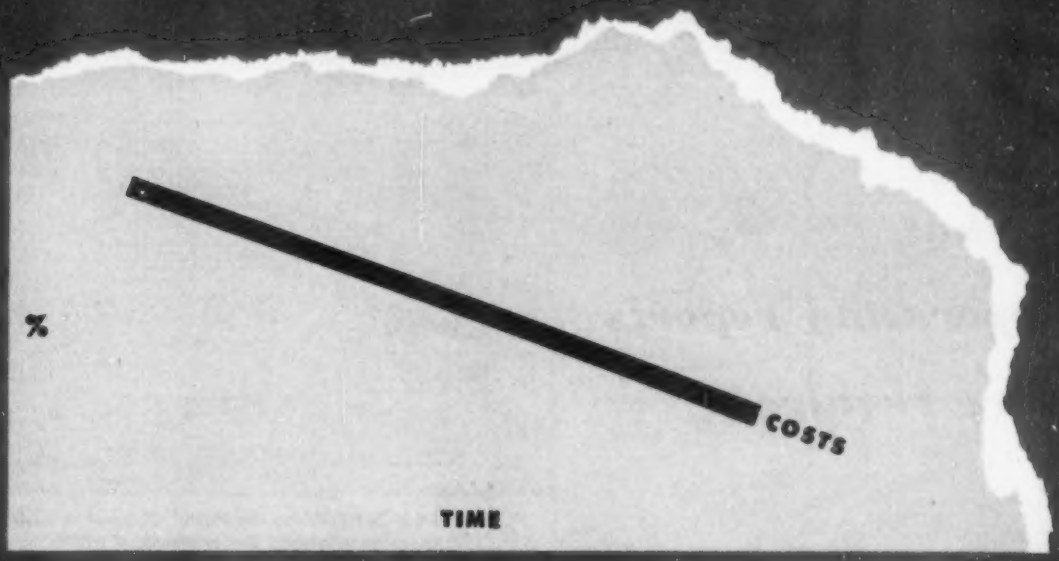
3. In some cases, the cabinets may be made in sections with inadequate bonding between the sections. To correct this, the panels should be removed and the contacting areas and butting surfaces cleaned of paint, rust and other foreign matter. At reassembly, precautions should be taken to obtain good electrical contact.

Suppressing radiation from coils or electrodes at the work station is far most difficult because the user is always faced with the necessity of getting work into and out of the heating zone. In some cases the size or shape of the parts makes it virtually impossible to shield the installation and still maintain good material flow. A user might well find himself faced with the task of building a shield around the heating zone, thus making it impossible for him to use his heater. In such cases, a shielded room or metal cage enclosing the heater, work position, material handling equipment, and operator may well be the only solution.

Fortunately for the users, as well as the manufacturers of this equipment, most applications can be handled so only the heating elements need be enclosed, as when material is handled on a batch basis, permitting the heating zone to be enclosed during the heating cycle.

In the case of the oven and cage shown in the illustration, these serve other purposes besides eliminating the radiation of radio-frequency signals. Operating personnel are protected from contact with high potential elements by the oven and cage interlocks.

Cooperation between the manufacturer and user of electronic heating equipment will do much to simplify the certification of heating installations. If requested, most manufacturers will be glad to review the user's radiation problem and submit their recommendations. If there is any question in the user's mind as to whether his equipment is emitting radio-frequency waves, a check can be made by the manufacturer or his representative.



how to control shop costs

BY ALBERT E GROVER, COST CONSULTANT

The purpose of cost accounting is to establish a basis for formulating sales policy and to furnish management with data for controlling operating activities.

As the purpose of business is service, its existence cannot continue indefinitely without profit. Profit can only be realized when there is good merchandising. Good merchandising, in turn, must be predicated on knowledge of the potential market, intelligent and accurate cost information, and a goodly amount of intestinal fortitude in the establishment of sales policies.

No matter how busy an executive is, he must devote a considerable portion of his time to a consideration of company profits. He must determine the source of these profits, as well as their size, to shape intelligently the best policies for his particular business. To do this he must have adequate information on costs and other operating statistics and must satisfy himself that this information is fundamentally sound.

In establishing sales policies, it is essential that he solicit business or products that the company is equipped to produce efficiently. These either return a profit on invested capital or, in periods of low production, recover all or part of the fixed cost of operating the business. To do this he must adhere to certain basic cost principles. Otherwise, sales quotations will be inaccurate and a menace, not only to the individual manufacturer, but to the industry as a whole.

In considering how the shop owner or executive can get the most out of cost accounting, management problems should be divided into two major classes: first, the establishment of sales policies, and second, the control of all operations involved in developing, manufacturing, and marketing the product of the company. Intelligent attention to these controls has a decided effect on the profit situation of the company.

This report describes methods of controlling manufacturing costs that can be applied in jobbing as well as production shops. It does not go into accounting details, but rather concentrates on the basic concepts underlying common costing methods. It points out their shortcomings and stresses the fundamentals upon which all systems must be based to produce accurate operating figures. Included is a discussion of the reports the shop owner or executive should have, together with suggestions as to how they can be prepared for maximum usefulness to him.

American Machinist SPECIAL REPORT NO. 331 TO THE METALWORKING INDUSTRIES

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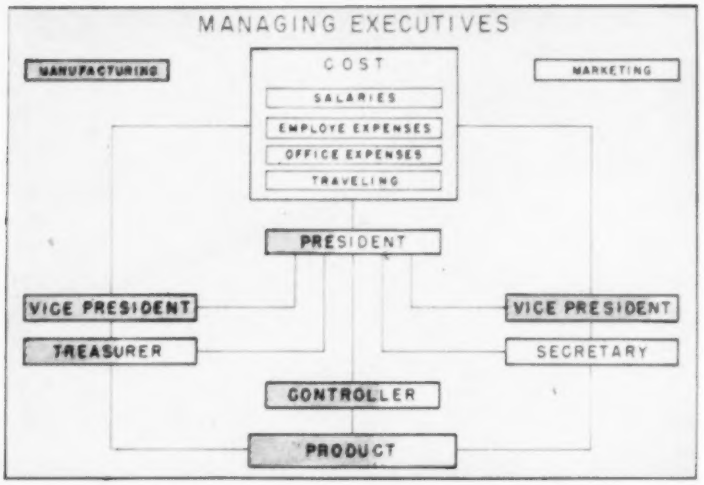
What operating reports are required?



COST CONTROL requires careful allocation of executive costs between manufacturing and marketing, if reliable figures are to be obtained. Often this cost exceeds that of an entire producing department in the shop. Chart shows typical division of these costs between manufacturing and marketing in an average plant

A major objective of any cost accounting system is to provide executives with information in a nutshell. No owner or manager can be expected to dig through a mass of figures to discover what's what. The manner in which operating statistics are prepared and presented has much to do with the ease with which effective control can be maintained over manufacturing activities.

At the outset, it is important to determine:

1. What reports are required
2. What items should be included in each report
3. To whom the report should be given
4. How often the report should be prepared
5. How they can best be used

First of all, there are two major types of reports: (1) those that show the status of the business at any particular time, and (2) those that summarize the gains or losses from operating the business.

The financial status of the business usually is shown on the balance sheet. If properly prepared, this not only tells how strong or weak the business is, but also the particular places where the strength or weakness exists.

Gains or losses resulting from the operation of the business are shown in statements including: (1) the income from sales of the company's product, (2) operating costs, both manufacturing and marketing, (this report concentrates on manufacturing cost control), and (3) gains or losses, with reasons for the differences from expected amounts.

Regardless of the size and type of plant involved, management must have reports of this kind to make intelligent decisions. In large companies, the supporting data from which essential operating figures are obtained may be extensive. In small shops, the cost accounting system may be quite simple. But regardless of volume or the nature of production, the fundamentals of good costing are just the same.

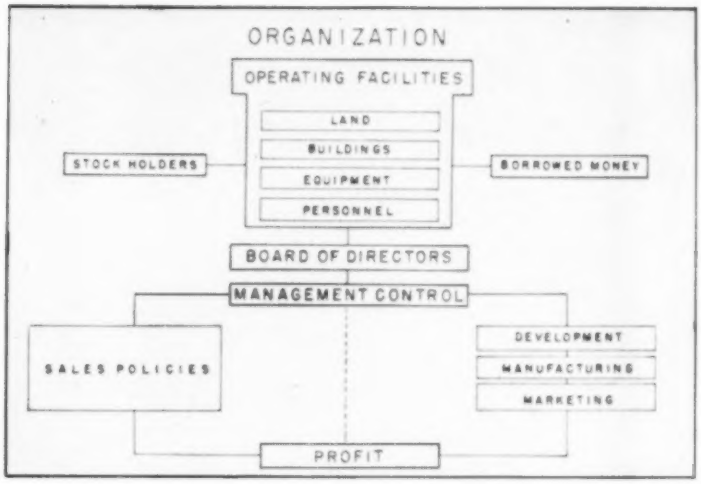
The problem of control may seem more complex in a job shop than it is in a plant producing a repetitive item. Basically, however, both plants are selling the same thing—conversion hours, or, in other words, actual operating hours that will be utilized in converting raw material to finished product. This, then, becomes the base upon which yardsticks can be set up for control purposes.

JOBBING AND REPETITIVE OPERATIONS

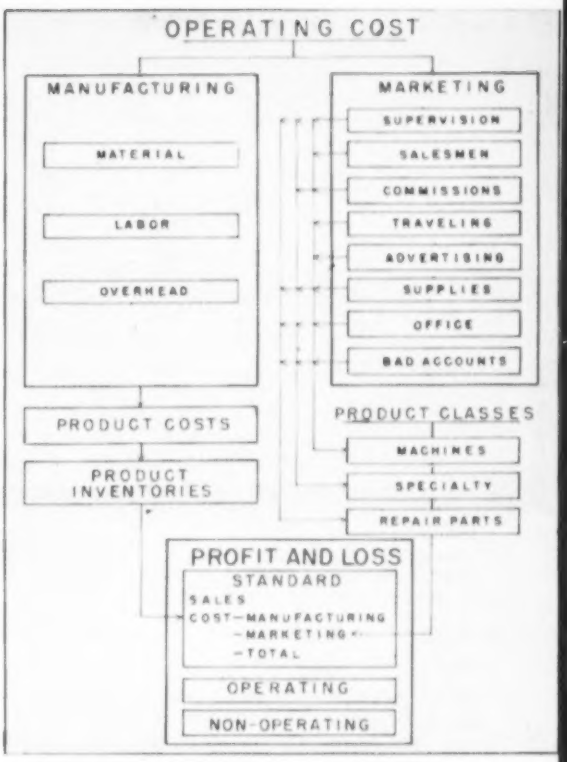
It is seldom that any one plant is purely jobbing or purely a repetitive production operation. Often, plants are a combination of both types. The same basic principles, the same approach, and the same basic methods of developing and reporting control information can be applied in either case.

Essentially, it requires computing normal operating hours for the plant, establishing machine rates for each cost center, and recording and allocating expenses according to sound costing practice. In repetitive manufacture, standard costs can be established. In jobbing work, this is not possible but standards can be set up. Actual costs then can be compared against anticipated results as expressed by the standard. Excessive deviation from standard indicates either that plant estimating is faulty or that conditions requiring correction exist in the manufacturing process.

The production shop employs machine rates, or some other measure, in establishing its cost standards. These standards then can be used in setting up a budget for the year. For any given period, variance from the budget can be broken down to quantity variances, which occur because the actual units of production sold vary from the budgeted amount, or to manufacturing variances, which can



PLANT FACILITIES are provided by stockholders or from borrowed money. Use of the facilities requires careful management control of the major phases of the operation to produce profit. Methods of control are presented in this report



MAJOR ITEMS OF COST in the average plant can be divided on the basis of those incurred in manufacturing and those incurred in marketing. In this report only those in manufacturing are discussed. A full cost system, however, must control both phases

be traced to shop operations. Unfavorable variances (direct labor costs higher than budget, for example) signal the need for effective management action.

The jobbing shop goes through exactly the same steps as the production shop up to the point that machine rates are established. At this point, however, the jobbing shop must obtain orders and estimate the time required for each. All planning and control then can be based on conversion hours—the number of hours the company expects to put in directly on orders on hand. The time estimated for the order calculated at machine rates results in establishing a standard cost for the order. The total estimates for orders handled in any period becomes the standard for the period against which actual hours and costs can be compared.

MEASURES OF PERFORMANCE

The total number of available operating hours in the shop also can be established as a standard against which actual hours operated in any period can be checked. The shop is set up for a given number of operating hours. The objective is to come as close as possible to full utilization of these available hours.

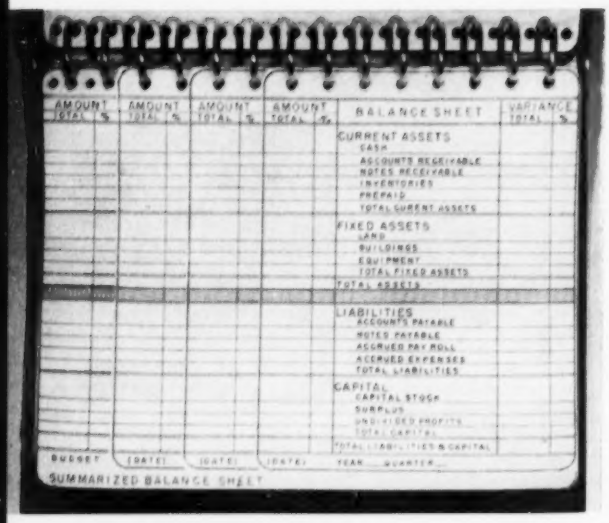
Details as to how normal operating hours are established and machine rates are developed will be explained later in this report. Both concepts tie in directly with the two basic costing methods most commonly employed in the metalworking industries to determine factory cost. These are the job-order and the standard-cost methods. The choice between the two depends primarily upon the type of product involved and the nature of the operation.

Job-order costing, for example, is the method most frequently applied when the product is made to customer specifications and rarely, if ever, involves a repeat order for the same item. Costs are accumulated for the job and the figures are analyzed to show operating results for any period or job.

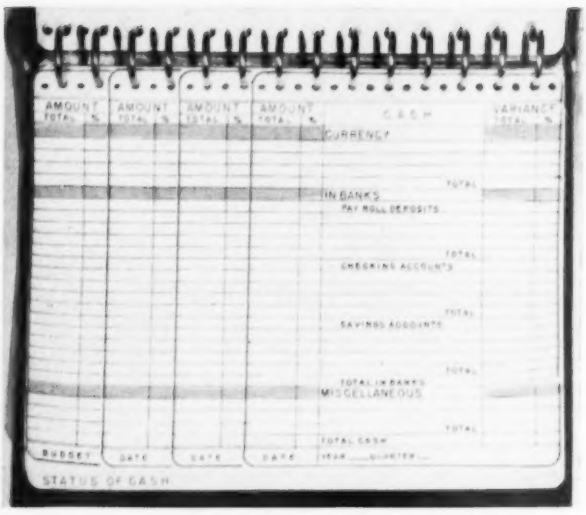
With job-order costing, customary practice is to break the job down into its subassemblies and components and to keep track of material, labor, and overhead assignable to each item. Work orders oftentimes are designed to show the amount and kind of material required and the operations scheduled for each piece. They also list the machine or machine group on which the operation is to be performed. In this way, the same manufacturing information required for production can be made to serve the needs of the stores, purchasing, payroll, and cost-accounting functions. For control along the lines previously mentioned, actual costs can be compared against the job estimates.

With standard costs, the basic framework is similar but the cost of producing each item of the product is pre-determined. It then becomes necessary to keep track only of deviations, or variances, from standard. For example, if a casting has hard spots and requires extra time for machining, the additional time is charged to variance. The cost of the casting is figured at standard and the variance is reported to management.

Systems of this kind are practical where production is repetitive. Where applicable, they permit close control over production costs and usually are less expensive to operate than other methods. The standards provide yardsticks against which ac-



SIMPLIFIED BALANCE SHEET shows company status for latest period. Lapping of sheets in ring binder permits ready comparison with other periods and with budget or standard. Balance sheet can be as simple or as detailed as plant requires



CASH REPORT breaks down balance-sheet figure to show where cash actually is. Each individual entry on the balance sheet can be detailed in similar fashion if owner or manager requires the information

tual performance can be measured. Variances generally are classified as to material, labor, and overhead. Usually, they permit analysis to determine the reason for above-standard costs. Budgets can be prepared readily and estimating is simplified.

REPORTS FOR EXECUTIVES

Regardless of which system is employed, however, it is possible to prepare reports containing the basic information required to permit effective control over operations. Executives should insist that these reports are comprehensive, accurate, timely, and easy to understand. Oftentimes, cost and operating reports are so cluttered with detail that management cannot and should not take the time to dig out the information that they want and *need*. Reports should contain just enough detail for intelligent analysis of the various activities of the business and to permit comparisons of each element of cost with budgets or standards.

Reports shown indicate the major types of information normally required and how it can be presented. The balance sheet, for example, contains the major accounts in which the plant owner or executive is interested. It purposely is very much consolidated so important elements of company status can be seen easily. Further, entries often are to the nearest ten dollars and, in large operations, to the nearest thousand dollars.

Figures in the *amount* column are actual dollar amounts on the last day of the month or period, whatever it may be. The percentage of each element to the total also is given to permit immediate, meaningful comparisons. The *variance* column, right, shows the difference between the actual figures and the budget or standard.

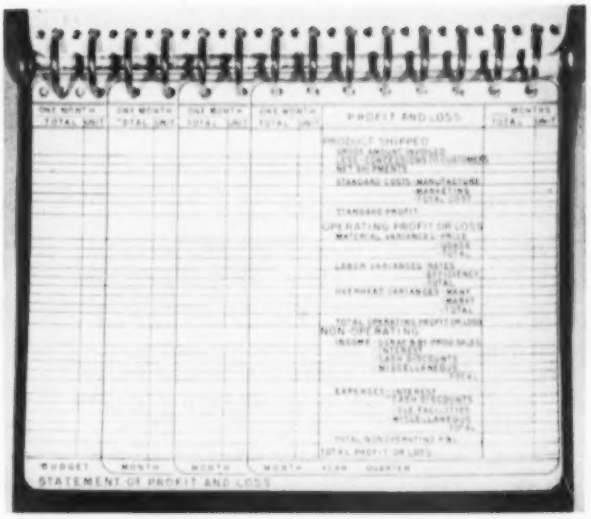
As many details as management requires can be provided by breakdowns of each individual entry in the balance sheet. The *status of cash* and status of inventories reports are examples of how this is done. These, in turn, can be set up to show far more detail, if necessary. For example, under *fixed assets*, the *equipment* entry probably should be supported by detail sheets showing: (1) each individual item of equipment in the plant (2) equipment by departments, and (3) by certain major products.

As is apparent in the illustrations, reports are entered in a ring binder (14 rings on ¾-in. centers). This is a very simple and effective manner of reporting operating figures and permits quick comparison of any particular figure with predetermined budgets. One period also can be compared readily with other periods. By contrast, reporting costs and other statistics for the month in a single folder usually requires recapping the details when comparisons are made. With the budget sheet at the left of the binder, report sheets for each month of the quarter are lapped so total and unit amounts are visible. If the budget changes, a new budget sheet can be inserted easily.

At present, there is a marked trend toward quarterly reporting of these figures. This can be accomplished very efficiently by transcribing data from the report of the third month of the quarter and placing it in another section of the binder. Thereafter, the succeeding last month of the quarter is placed so variances or cumulative figures are visible and immediately adjacent to those for the previous quarter. Thus, quarterly figures can be compared with any other quarter in the year and also with an established quarterly budget or standard.

Another form of reporting is accomplished by lapping (daily or other portions of the month) each month's accumulated data sheet on the master sheet. This permits management to compare monthly totals of each column with the established budget, as

INVENTORY STATUS is typical of the basic plan followed in arranging control information. Report for latest period is on top. Reports for preceding periods are identical in form and are located one below the other so the **amount** column is visible



PROFIT AND LOSS STATEMENT normally is prepared monthly. Arrangement shows all figures for one quarter. Left column of latest report (top sheet) shows actual figures for month for each element in statement; also in **unit** columns, the percentage of each element to net shipments. Actual figures for two preceding months are visible through lapping, as are budget or standard figures, far left

well as each month's accumulated data with that of other months of the same year.

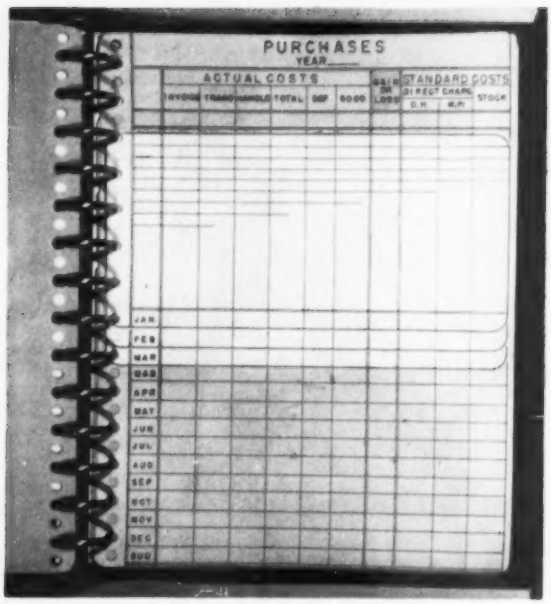
A complete and comprehensive monthly tabulation of detailed operating data on a single subject is shown on a single page of the multiple-ring binder. The flexibility of this method of reporting is almost unlimited.

There are, of course, other methods of reporting control information. However, after more than 30 years experience with cost control systems, the writer feels that the method shown is the simplest and most convenient he has yet encountered. It

HOURLY OPERATING COST is key record in job estimating and cost control. Separate sheet is made up for each style and size machine. Labor rate and variable overhead are added to give total, which is the out of pocket point. Fixed overhead is added to give second total, which is the breakeven point. This plus a percentage for return on investment gives final total, column at right. Column headed **D.L. Basis** shows percentage of overhead to direct labor for those who prefer to figure overhead as a percentage of direct labor. This tabulation plus **job estimate sheet** are invaluable in jobbing operations

JOB ESTIMATE SHEET includes columns for all information required for an accurate estimate. Hourly rates can be obtained from table, **hourly operating cost**, above, right. Sheet can be lapped to show **cost each** and **time each** on repetitive lots

BREAKDOWN BY PRODUCT shows figures entire year on one page. Products are identified by number in the left column. Total units shipped, and dollar value of shipments are entered in next two columns. Real control data lies in comparison of actual vs standard profit, column at right. Same basic form can be used to check year's business with plant's customers (page 162)



CONTROL OVER MATERIAL PURCHASES can be maintained through record comparing actual vs standard costs. This can be applied equally well to jobbing or repetitive operations. Gain or loss column represents difference between standard and actual costs. Figure is a measure of effectiveness of purchasing policy

applies equally well to profit and loss statements, profit breakdowns, purchase reports, labor reports, shop losses, and breakdown of other control information. A number of these reports are shown. In all cases, the principle is the same: reports are condensed for maximum usefulness, and are supported by breakdown of individual elements to whatever degree is required, and are lapped in the ring binder for ready comparison of one period to another or to a budget or standard.

The *profit and loss statement* is extremely important for controlling operations. It is here that the owner or executive finds warnings of trouble in the trends revealed by the comparative figures. Actual figures are given in the left column, cumulative figures in the right. Plants employing standard costs enter values for *gross amount invoiced,* etc., at standard. Differences between actual costs and standard are recorded in the section entitled *operating profit and loss.* Shops that do not employ standard costs often do not use this section of the report.

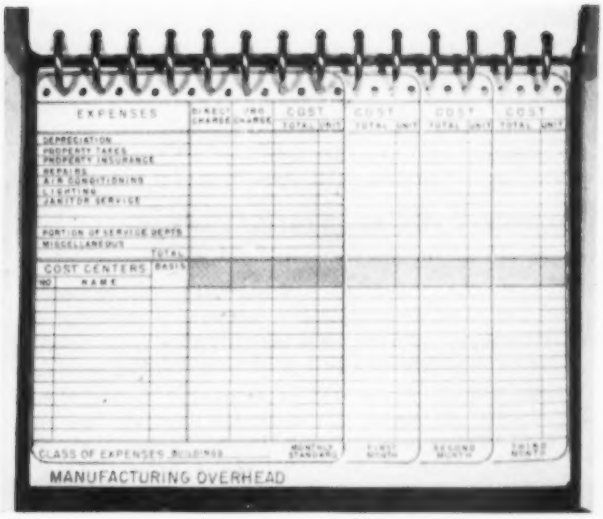
It is possible, however, to establish standards through job estimates. In effect, the estimate becomes the standard. These standards can be used to compute *standard profit* and the differences between actual and estimated figures can be stated in the *operating profit and loss* section. In this way, executive attention is focused on the areas in which profit leaks exist.

If estimates are to be of any value, they must be accurate and complete. A typical *job estimate sheet* is shown. One sheet is made up for each component, sub-assembly, and assembly. Operations are listed, together with the machine required or department involved and the time required. The cost rate for each operation then can be selected from the tabulation entitled *hourly operating cost.* Labor and overhead costs can be computed and totaled. To this figure, profit is added, then material costs. Space at the bottom of the form is for tool or other costs to be spread over the life of the job.

It should be noted that profit is not computed on material. All shops, basically, sell the same product —conversion hours—and it is only on the cost of conversion that profit should be based. For the same reason, the practice of totaling material and labor and then applying an overhead percentage is very misleading and should be avoided. There is no relation between labor cost and material value. Applying a straight percentage to the sum of material and labor may result in a cost that is entirely out of line with true conversion costs. Shops figuring on this basis put themselves at a distinct disadvantage in comparison with competitors employing accurate figures.

The *hourly operating cost* tabulation is one of the most useful tools yet developed for cost estimating and control in jobbing operations. One sheet is made up for each individual style or size of machine or equipment or type of handwork operation. Each direct labor rate, *D.L.*, for the given work or type of machine is listed together with the variable overhead, *O.H.*, (those items that normally vary with production, or, to put it another way, that normally do not occur when men are not working—as power,

CONTROL OVER LABOR COSTS is exercised through two major types of information, each of which is recorded on basic form shown. ***Labor by classes*** is made up for each department of plant. Each sheet is for one department. All classes of labor in the department are listed in the left column. Variance is difference between standard and actual. Lapping accumulates in one place all monthly reports for one department for one year. Second control is ***labor by departments***. One sheet is prepared for each class of labor. All departments of the plant are listed in the left column. This shows labor trends on plant-wide basis (page 162). First report showed individual department performance

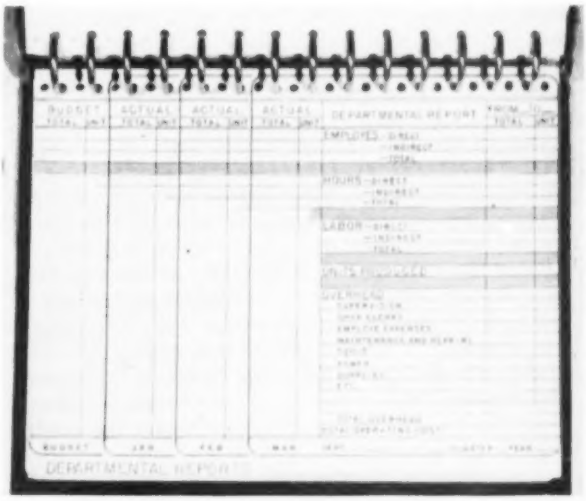


MANUFACTURING OVERHEAD is figured according to major classes of overhead expense. A typical breakdown includes buildings, equipment, indirect labor, employee expenses (medical plans, welfare, etc), supplies, and miscellaneous. Elements making up each class then are allocated to cost centers listed below double line. Some items can be charged directly to a cost center, left column, others must be allocated, next column

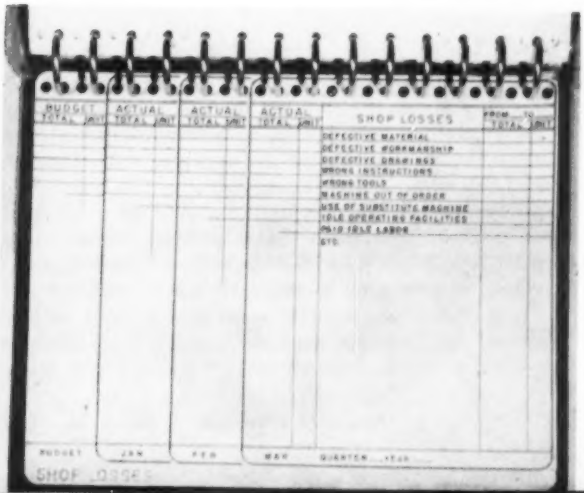
repairs, supplies, etc). These, totaled, make up the out-of-pocket cost that is, the cost incurred just by taking the job. No shop should ever take jobs below this figure.

To the out-of-pocket cost, fixed overhead is added to give the breakeven point. At this figure, the company just recovers its total operating expenses from its customers. A fixed percentage that accounts for capital investment is added to obtain the total figure used for estimating. Overhead rates are based on normal operations. How these are computed is explained later in this report.

The center column of this tabulation is entitled



DEPARTMENTAL REPORTS are given to each foreman. Section entitled **employees** shows the number of people employed in the ACTUAL column under TOTAL. Percentages are listed in the UNIT column. For example, percentage of direct to total employees. Report on **hours** is very revealing. **Units produced** entry can be expressed in hours for jobbing operations



SHOP LOSSES are reported for each department. This report provides valuable control information for each departmental foreman. Left column (top sheet) shows actual dollar amount for each item and its percentage of the total. Cumulative figures are shown in column at right. Lapping one sheet over the other permits monthly and budget comparisons. Even if no budget is employed, report is essential to show trends

D. L. Basis. Under the column *O.H.* the sum of the fixed and variable overhead is listed. The ratio of this figure to direct labor, *D.L.*, is expressed as a percentage in the next column. Although not recommended by the writer (for reasons that will be explained later), this practice of expressing overhead as a percentage of direct labor is common.

REPORTS FOR OPERATING CONTROL

Additional breakdowns on profit can be prepared if required. Analyses can be made, for example, on the basis of each of the company's products, or by customers. In the form suggested for these breakdowns (*profit and loss by sales units*), reports for each month (white sheets) overlay a second sheet (shaded) on which the columnar headings are entered. There is space (not shown) on this sheet for charting certain information contained in the individual reports. Those most commonly required by owners or operating executives are curves of actual profit, standard profit, and sales. These charts graphically portray important trends in the company's business.

To check upon the effectiveness of purchasing policy, the form entitled *purchases* is suggested. To the invoice total, the cost for freight and handling into the plant is added. These values then are charged into overhead, work-in-process, or stock, depending upon the item. For example, supplies go into overhead, motors purchased complete go into work-in-process, and raw material goes into stock. Actual vs standard indicates gain or loss, the important control figure.

One of the most important elements to be controlled in the average shop is the cost of labor. Control, of course, is exercised at the point of use. A measure of the effectiveness of control, however, can be obtained through labor reports of the type entitled *labor by classes.* One report is made up for each department and the figures indicated are listed for each of the various classes of labor employed. For example, a typical breakdown might include: direct processing, supervision, clerical, indirect, supplementary, overtime, paid vacations, etc. However, the breakdown can be varied to suit the needs of each particular situation. Reports for each month show actual figures. Cumulative results are entered on the master form (shaded area).

To give the owner an over-all picture for the entire plant, the report, *labor by departments*, is prepared. In this case, total figures for each department of the plant are entered, with a single line for each department. Plant-wide performance is immediately apparent. To supplement this summary, individual *departmental reports* can be prepared. One of the key items to be watched is the ratio of indirect labor to total labor.

To control the very important item of shop expenses, the owner or executive should have the monthly cost report entitled, *shop losses.* Detailed breakdowns are essential for good control. For example, although the report illustrated has only a single entry "paid idle labor," this might very well be broken down to "waiting for material, waiting for setup, waiting for inspection, waiting for tools, waiting for repair," and so on. How detailed the breakdown should be is determined by the conditions in any given plant or department. A breakdown, of course, focuses attention on the real trouble spots in the organization and indicates the areas in which corrective action must be taken to reduce losses.

OPERATING DATA BOOK

For ease and convenience in application, the owner or executive should have all reports in a single ring binder. All essential operating figures then are readily available in conveninent form for meetings and conferences where such data may be required to guide decisions. All top executives should be provided with this book: owner, general manager, manufacturing manager, treasurer, and so on. In addition, reports containing figures for individual departments should be supplied to the departmental foreman concerned. The foreman, in the final analysis, is the key man in controlling costs. Top management need only take action when control at the point of use is not as effective as has been anticipated in the budget or standards upon which company policy is based.

How to set operating standards

The phase of cost accounting that probably has had the greatest impact on management practice is the development and use of operating standards. As previously pointed out, standards can be applied, and should be developed, for jobbing as well as production operations. In the job shop, standards are developed for conversion hours and are recorded in the *hourly operating cost* form previously shown. In the production shop the procedure can be carried a step farther and standards can be developed for individual product items. In all plants, it is essential that standards accomplish the following results if they are to be worthwhile:

1. Provide information that will permit a company to enter competition with the full knowledge of what it should cost to develop, manufacture, and sell each of the various items in the company's product line. This information should be predicated on normal operations. Sales policies, based on a solid foundation of this kind, will tell management when to accept or to refuse business, and *why.*

2. Establish yardsticks for the various activities of the business against which it is possible to compare actual performance. This informs man-

agement of irregularities in operation. Knowledge of these conditions makes it possible, in most cases, to reduce losses that otherwise might go undetected.

WHEN TO USE PAST PERFORMANCE

Many companies establish their operating standards from averages of past performance. This is satisfactory if past performance is comparable with present conditions. The following conditions should obtain:

(1) Raw material prices must have been the same as those prevailing today.

(2) Wage rates and methods of bonus or premium payment also must have been the same.

(3) The volume of business must have been in the same ratio to the capacity of the plant at that time as is current production to present capacity.

(4) The method of production and type of operating facilities employed must have been comparable with those now used or contemplated.

Dependable standards can be determined only on the basis of a company's normal capacity to produce and sell with present buildings, equipment, and personnel. There are certain cost items, of course, that can be determined only by reference to past records. In these cases, ratios are established between the actual expense and the volume of work performed. These, then, can be used as a guide in establishing fair and reasonable costs for present plant capacity.

While some costs remain constant regardless of the business cycle, others vary widely as production volume fluctuates. There rarely is any uniformity in ratios established between various items of cost and production factors such as weight of material, number of pieces produced, direct-labor costs, or direct labor hours. Therefore, to establish dependable standards, each element of cost must be treated separately. It is equally important that consideration be given to the use of the equipment necessary for standard production. Furthermore, no administrative expense that is not required for standard production should be included in standard costs.

Major items of cost that must be controlled may be divided into three classes: (1) product material, (2) labor applied to individual jobs, commonly termed direct labor, and (3) expenditures not practical to apply directly to individual jobs, commonly termed burden or overhead.

Overhead may be further classified as:

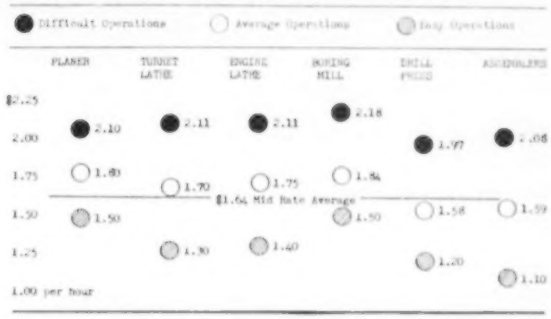
1. Building expenses: those necessary to house the various activities of the business.

2. Equipment expenses: those necessary to operate and maintain tools.

3. General expenses: supervision, clerical help, and other expenditures necessary to maintain working facilities.

These must be carefully recorded and properly related to the basic conversion hours the plant has to

RATE RANGE FOR OPERATORS



VARIATIONS IN OPERATOR RATE MUST BE CONSIDERED

sell. No matter what the nature of the product may be, the manner in which standard costs are applied to individual jobs has a decided effect on the ability of the company to prosper. The wide-awake company will manufacture only such items as the plant is equipped to produce efficiently and will establish effective controls over wastage in manpower, material, and the use of fixed and perishable assets.

INVENTORY CONTROL

When capital is in the form of cash, it is carefully protected, its receipt and disbursement safeguarded, and its custodians held to a strict accounting. Once this capital is converted into material, however, there is a tendency to become lax to lose sight of the value of the investment, and to tolerate practices that are waseful, inefficient, and needlessly expensive.

Executives of many manufacturing companies do not think it practical, from a clerical standpoint, to maintain control over the receipt and usage of raw materials. However, the same companies keep careful records of cash, accounts with suppliers, and transactions with customers. If more clerical help is required to keep these records, it is provided without hesitation. However, there is as much, and sometimes more, liability for lost dollars caused by misuse of materials than by misuse of cash and accounts for suppliers or customers.

Admittedly, it takes clerical effort to maintain a perpetual inventory. However, it also requires a considerable amount of effort to measure and price an annual inventory. Some manufacturers say that it costs them more to measure and calculate the value of the many items of inventory taken at the close of the fiscal period than it did to maintain an accurate and dependable item-control continuously during the year. They also state that, in no instance, did they find the yearly actual inventory more accurately stated than the book inventory.

The function of a system of control over inventory is:

1. To furnish the purchasing executive with information that will be helpful in securing materials especially adapted to the company's product at the right time and price.

2. To show quantities of materials on hand in relation to work in the shop.

3. To furnish the accounting department with values for substantiation of "inventory values" that are reported to management.

PERPETUAL INVENTORIES

Perpetual inventory control should be maintained on raw materials, purchased parts, and finished units. Some manufacturers record only quantities; others carry values as well as quantities. Some have so perfected their systems that they are able to dispense with annual physical count and pricing.

As inventory values are a vital part of any monthly operating statement, it is important to keep a constant control over both quantity and value from the time materials are received until finished units are shipped.

The value of raw material inventory should represent market price if the material was purchased in the usual quantities and under the usual purchasing methods. If purchased at abnormally high or low prices, normal market price should be used in figuring inventory values, and the variance from actual cost taken as a "purchasing gain or loss." In this way, purchasing gains or losses are shown in the accounting period when they actually occur.

When market values change in any marked degree, the values on the inventory records should be adjusted. Variance is taken into gain or loss. In this way, the inventory values on the balance sheet reflect the current market value of the material.

To be effective, however, this method of inventory pricing should be tempered with common sense. Items of little value, where the variance would be too small to make any appreciable difference, should be shown at actual cost. However, many good systems are killed by too liberal interpretation here.

WORK-IN-PROCESS INVENTORY

The value of the work-in-process inventory should include: (1) materials at market value; (2) labor at standard costs; and (3) overhead at normal rates. As the variances between actual and market prices are adjusted in the raw-material inventory records, no further adjustment is required in figuring work-in-process value.

Among more and more manufacturers, labor is being charged at standard with differences from standard being taken up as variances. Companies that do not have a standard cost system, however, compute their inventory values on the basis of actual cost.

The value of finished-product inventory should be computed in the same way as work-in-process.

RESERVED STOCK

In maintaining the raw-material inventory, it is not sufficient to know only the quantities of materials actually on hand. Management also must know how much of that material will be used on orders already booked even though it has not as yet been delivered to the shop. That part of the inventory required for orders booked is termed "Reserved Stock."

Many companies show the amount of reserved materials on the regular stock card. There is less confusion, however, and just as much economy in carrying separate records for reserve and actual stock. Such records should be maintained for: rough castings; rough forgings; bearings, parts bought outside; special steel shapes; special bolts, nuts, etc; stock parts and assemblies; and other materials of a special nature.

Materials such as standard steel shapes, bolts, cotter pins, lumber, washers, paint, etc do not require reserve stock records. These items can be stocked with maximum and minimum quantities for reordering.

Many perpetual inventories are a disappointment to management because no systematic method of verification is followed. Some then condemn the principle of perpetual inventory and abandon it. In so doing they abandon the only possible check on fluctuations in inventory values during the year.

LABOR COST ACCOUNTING

Time is the real foundation for all labor costs The method of wage payment, whether on the basis of units, points, hours, or minutes, makes little difference. The principle is to establish cost based upon the time required to perform the job.

All labor is divided into two classes: direct labor, which performs the function of the department in which it takes place; and indirect labor, which contributes to the maintenance of the operating divisions of the plant.

In applying direct labor to operations, consideration must be given to fluctuations in hourly rates caused by the type and intricacy of the operation, by the number of processing units operated simultaneously by a single operator, and by operations requiring two or more employees.

Allocation of direct labor to specific operations is performed in a number of different ways. The most common methods are: on the basis of the average hourly labor rate of the entire plant; on the average of a specific department; and on the actual hourly rate for a given operation. The accompanying illustrations show the effect on product cost of these different methods of allocation.

While it would be possible to distribute all indirect labor items to the product, the results would not warrant the effort required to make this minute distribution. Therefore, it good practice to include these costs in overhead and allocate them as such.

To report labor figures in relation to the expenses of several producing departments, the lapped forms previously explained can be used. They also can be employed to show in simple and comprehensive form the labor statistics related to a single department. In each case, provision is made to segregate costs based on straight day work and those that are based on premium or piecework. Variances between actual and standard are expressed both in hours and in labor cost.

How to allocate manufacturing overhead

The most difficult cost to standardize is that of the waste and use of physical assets. While there are a number of different bases for allocating these elements of cost, those most commonly used are: (1) the same rate for all operations; (2) the same rate for all operations in the same department; and (3) individual rates for each machine or group of similar machines.

The determination of a proper base in establishing overhead standards is all-important. It must be predicated on a thorough analysis of cost elements in relation to specific activities. Dependable results can never be obtained by averaging unrelated elements.

HOW TO ESTABLISH NORMAL OPERATIONS

Changes in volume caused by conditions beyond the company's control make it advisable to base costs on normal operations. Otherwise, in times of low production, the cost of idle capacity (perhaps nonexistent at that time in a competitor's plant) may be included in the cost. This may increase the sales price to the point of refusing business, which, if secured, would reduce the idle-capacity cost. On the other hand, quotations or sales policies based on actual cost in times of high production tend to reduce income from sales (when higher prices may be had) to a point where sufficient funds can not be set aside to permit proper maintenance of physical facilities during the next period of low production. Thus, as long as there are fluctuations in business, it is best to operate with normal costs.

The starting point in establishing normal costs is to establish the normal operating hours for each facility in the plant. A formula for establishing these figures is shown in an accompanying box and, in the main, is self-explanatory. The net available working hours as obtained from this formula are reduced to cover downtime for normal repairs, changing jobs, rest periods, and other unavoidable causes. Lack of business or personnel should not be considered as downtime. Thus the final figure represents the actual hours that the facility is expected to operate.

The amount of the allowance varies with the type of the equipment and the operation being performed. Neglect in recognizing this variability can be a contributing factor in establishing unreliable cost figures and formulating unwise sales policies.

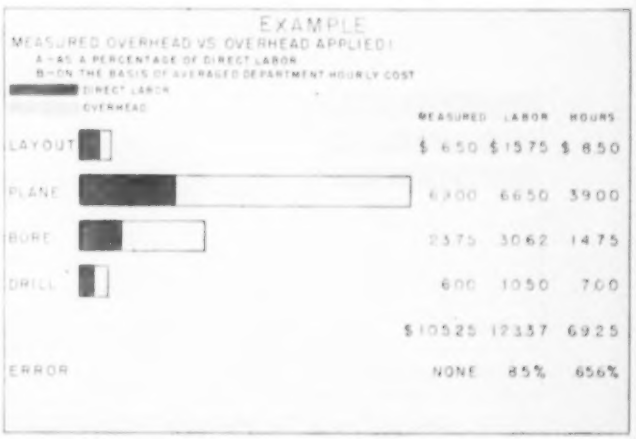
To simplify the task, normal operating hours can be figured for each cost center, which may be a single machine but often consists of a group of similar machines. The next step is to allocate overhead to the cost centers and divide overhead by normal operating hours to obtain the overhead rate for each cost center expressed in dollars per hour. Rates so established then are recorded in the *hourly operating cost* form previously illustrated.

For the purpose of establishing machine rates, overhead normally is grouped in the three major categories previously given: building, equipment, and general expenses. Building expenses generally include depreciation, property taxes, property insurance, heat, light, repairs, etc. The total is converted to dollars per square foot of floor area and

How to determine normal operating hours

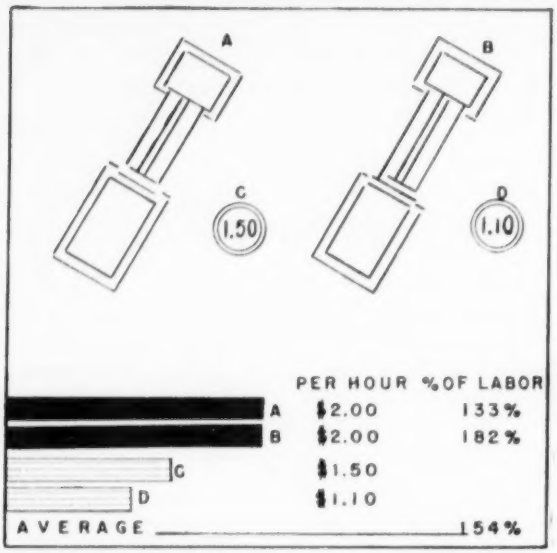
One year's operation			365 days
Legal Holidays - New Year Decoration Independence Labor Thanksgiving Christmas		6 days	
Vacation allowances		10 days	
Saturdays		52 days	
Sundays		52 days	
Other anticipated shut down		5 days	125 days
Available working days in the year			240 days
Established working hours per day			8 hours
Available working hours for the year			1920 hours
Unavoidable down time allowance	10%	192 hours	1728 hours
	20%	384 hours	1536 hours
	30%	576 hours	1344 hours

NORMAL OPERATING HOURS are determined by deducting an allowance for unavoidable downtime from the available working hours for the year. This allowance accounts for the fact that no machine operates 100% of the time. The allowance, however, is in no way connected with allowances used in establishing efficiency or time standards. The actual amount of the allowance varies among different types and sizes of equipment. For two- or three-shift operation, a new figure for available working hours is computed. Allowances also may vary when machine operating hours are increased

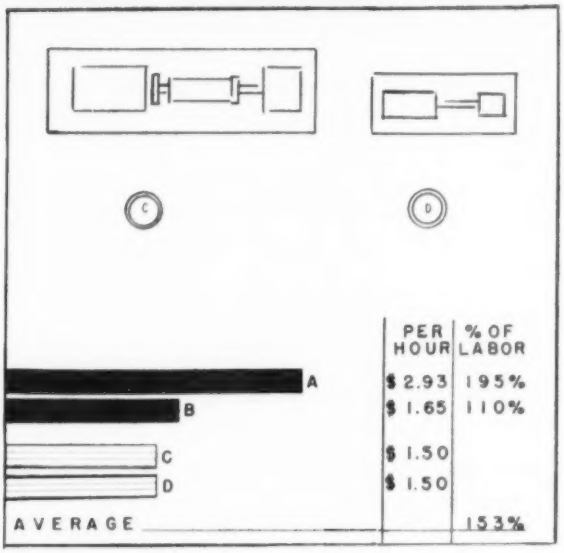


COMPARATIVE COST FIGURES computed by three different methods of allocating manufacturing overhead reveal a wide difference in results obtained. Figures under the *measured* column are based upon machine rates. In the next column, overhead is figured as a percentage of direct labor costs. Figures in the final column are based on an average departmental cost rate

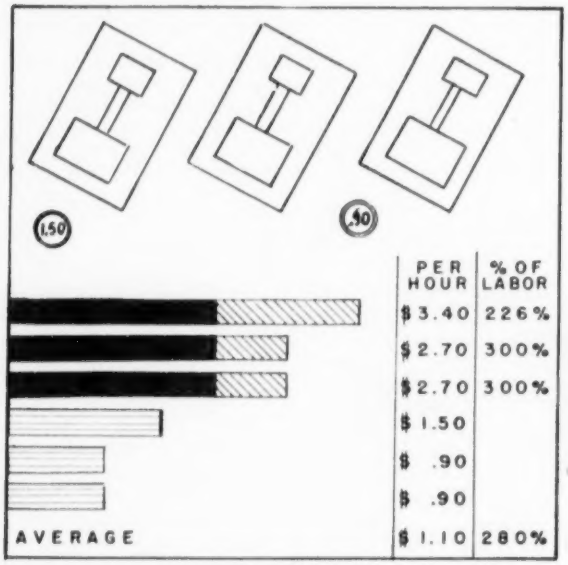
HOW OVERHEAD, EXPRESSED AS A PERCENTAGE OF DIRECT LABOR COSTS, VARIES



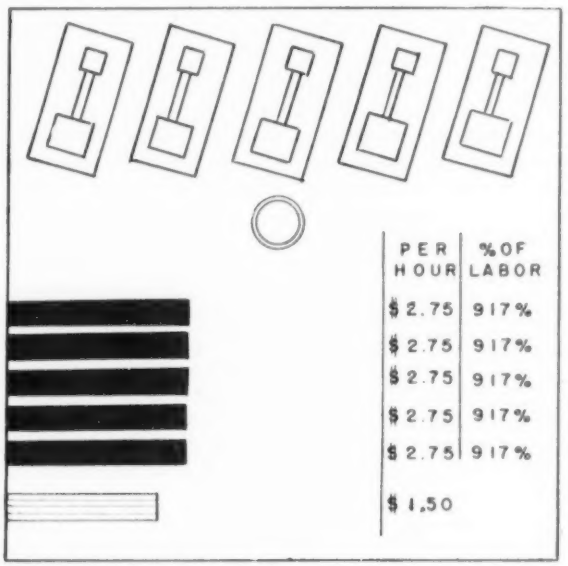
A Identical machines with operation of differing skill



B Same type but different size machines



C Identical machines but two operators being paid different rates



D One operator runs a machine group

the portion assigned to any given cost center is determined by multiplying this rate by the floor area of the cost center.

Equipment expenses include depreciation taxes, insurance, power, repairs, etc., and is allocated to a given cost center according to value. The value of the equipment in the cost center in relation to the total value of all plant equipment determines the percentage to apply to each cost center.

General expenses are allocated on the basis of production hours. The percentage is determined by the ratio of the normal operating hours of the cost center to the total normal operating hours of the plant.

There are other bases for allocation, of course. However, this method is favored by the writer as being accurate and reliable for the majority of plants.

Having determined the total overhead for the cost center, it then is a simple matter to establish the rate per cost center by dividing overhead by normal operating hours.

In contrast to this procedure there are a number of other methods for applying overhead that, while commonly used, are far less accurate. The most popular of these are listed in an accompanying box. To check the soundness of his cost figures, the shop

owner or executive should consider the weaknesses of these various methods.

A common practice is to apply overhead as a percentage of direct labor. This method, however, is so unreliable that it should be discontinued in all shops. A more dependable method is one that reflects the wide differences in the cost of operating facilities of different character and size. For example, as is shown in the accompanying illustrations, it costs far more to operate a $50,000 machine than one which costs $5,000.

It also must be recognized that there are variations in the wage rates of individuals in the same plant who may operate machines of the same character and size. The intricacy of the operation usually determines the skill of the operator which in turn fixes the base upon which wages are set. Consequently, there can be no consistent relationship between the direct-labor cost of an operation, and the total cost to operate the machine.

If one operator runs more than one machine, an over-all overhead rate based on direct labor produces erroneous costs for the item produced. The same is true of operations requiring more than one operator.

Because of certain fixed items in overhead, the ratio of overhead to direct labor decreases as production increases. Therefore, allocation of overhead on the basis of a percentage of direct labor also is unsound.

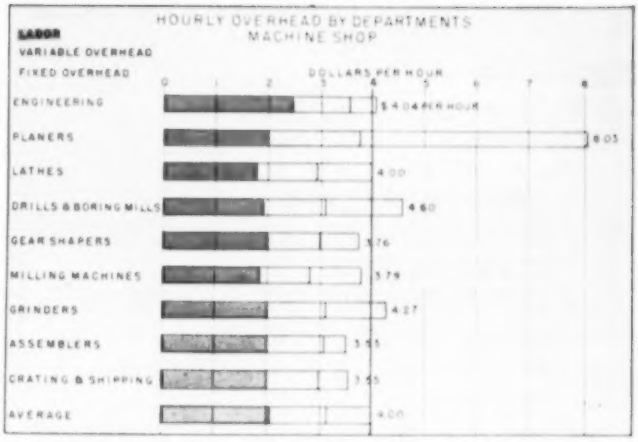
Allocating overhead on the basis of direct labor in hours, eliminates inaccuracies caused by variances in direct labor hourly rates, but does not recognize the tremendous variances in the operating costs of different types and sizes of processing facilities. To show the effect of differences in hourly rates of operators, and in actual overhead costs of different types of equipment, a number of examples are given in the boxes at left.

Exhibit *A* considers the case of two identical machines operated by men of differing skills. In this case, overhead as a percentage of direct labor is 133% on one machine and 182% on the other.

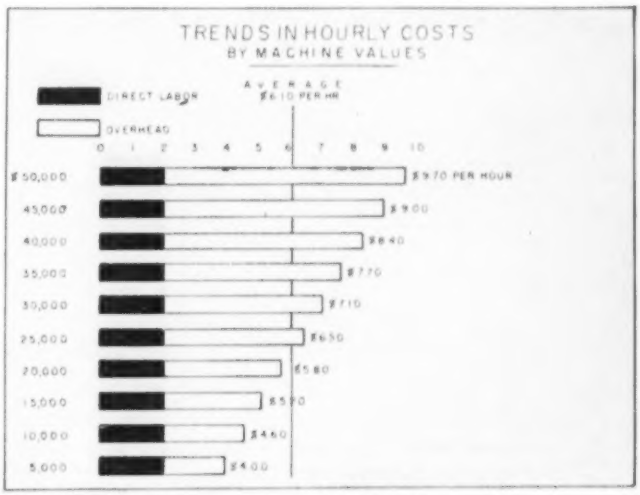
Exhibit *B* illustrates the fallacy of applying overhead as a percentage of direct labor in a department where machines are of the same type, but are of different size. In this case, although both machines are turret lathes, overhead on the small machine is 110% of direct labor and on the machine 195%.

Similar variations are shown in Exhibit *C* which takes up the problem of operators paid different rates to operate different machines of the same type and size. The same is true of Exhibit *D* which covers the case of one man operating two or more machines.

Undoubtedly it requires less clerical effort to divide the overhead for an entire department by the direct labor, and use the percentage obtained in costing items of product being produced. In fact, some executives feel that because the product units flow through both large and small machines there is no need for computing individual machine rates. This can be justified only when the time for machining the product on the small machine is in the

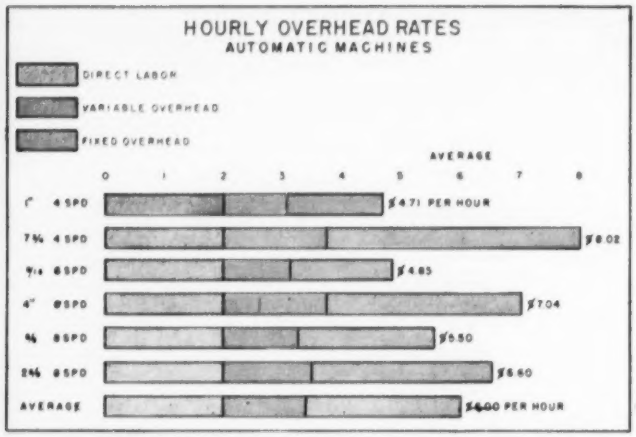


COMPARISON OF PLANT AVERAGE COST to individual department cost rates reveals wide variation. Plant average is $4 per hr. Departmental rates are better but still result in considerable inaccuracy

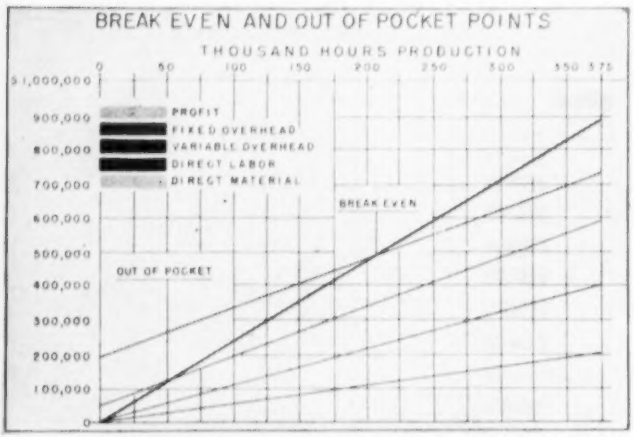


EFFECT OF OVERHEAD on actual cost rate of individual machines results in machine rates that differ widely from departmental average. Danger in applying departmental rate of $6.10 per hour is apparent

MULTIPLE-MACHINE SETUPS cause variation in percentages of overhead to direct labor when this method of costing is employed. Top line shows percentage when one man operates one machine. Overhead is 820% of direct labor if man is paid $1.40 per hour



MACHINE RATES FOR AUTOMATICS in a midwestern plant vary from $4.71 to $8.02 per hour. Average is $6 per hour. Comparisons of this type show need for individual machine or cost-center rates



BREAKEVEN CHART is very useful in determining effect of changes in sales policy on company profit position. Anything that lowers total dollar volume of sales, heavy line, flattens slope of line, moving both out of pocket and breakeven point to right. This means that a greater number of production hours are required before profits start. Same is true if volume remains the same but costs rise

same ratio to the hourly operating cost of the machine as the time spent on the large machine is to its hourly operating cost.

In one plant in which the over-all average of overhead to direct labor is $2.70, the average in the planer department is $6.09. Within the department, the smallest planer normally costs $4 an hour to operate, the next larger size, $4.80 per hour. A third planer requires $7.68 per hour, and the largest machine costs $8.20 per hour.

As jobs flowing over these machines usually require considerable time compared to machines in other departments, it is senseless to apply the plant average of $2.70 to the work performed on these planers. Furthermore, it would not be dependable to use the $6.09 department average. In contrast to this situation, the average in the milling machine department of the same plant is lower than the over-all plant average.

The operations making up the greatest percentage of factory cost in the majority of metalworking plants, are machining and presswork. The establishment of a standard cost per hour for each type and size of machine and press is of material assistance to every manufacturer in calculating production cost, in measuring the cost of idle equipment, and in analyzing purchases of new machines.

PRODUCTION COST CALCULATION

The prime reason for establishing machine rates is to develop accurate product costs. Greater accuracy could be obtained by using accurate machine rates and a blanket labor rate than by using a blanket overhead rate and a measured labor cost. This, of course, is because in the average machine shop there is a maximum spread of 20¢ per hour in direct-labor costs, and a spread of $2 an hour in overhead rates on different machines.

MEASURING COST OF IDLE EQUIPMENT

Owners and managers should be provided with a periodic report of the hours that equipment is idle at normal shop operating rates. This cost, expressed in individual machines, will help in controlling profits by:

1. Indicating how to keep the investment in equipment to a minimum for efficient operation.
2. Showing where to load machines with outside jobs to reduce idleness expense.
3. Focusing attention on machines that should be sold, thus stopping their idleness loss.

WASTE ANALYSIS

Waste may occur in capital investment, in materials, and in the use of labor. Capital investment provides facilities for sufficient men working a normal number of hours to produce an anticipated volume of business. Failure to perform required operations or to market the product up to established standards will result in wasted capital expenses, such as: depreciation, property taxes and property insurance. These costs continue through boom, normal and depression periods (except that portion of depreciation caused by wear and tear in production).

In periods of low production, these wasted capital costs cannot be directly controlled. A wise executive, therefore, recognizes that these periods are sure to follow periods of normal and overproduction and establishes sales policies on costs to absorb these capital expenses over a period of years. In this way he accumulates a surplus to compensate for wasted capital expense occurred in periods of low production.

Any system of accounting recognizes the presence of property taxes and insurance. But there are a few manufacturers who do not recognize the element of obsolescence in depreciation. In many types of equipment, the obsolescence element in depreciation is a larger increment than the replacement cost caused by worn out and broken facilities.

Good costing methods will aid management in reducing wasted capital expenses by:

1. Establishing normal costs per hour to operate each department and each machine within the department if conditions indicate that individual machine rates should be computed. Without these departmental and machine standards, a true cost of wasted capital expense cannot be determined.

2. Reporting wasted overhead, for each day's operations, immediately after performance. Management then will be in a position to take corrective measures on incompleted jobs.

Wasted capital expenses may be reduced by:

1. The introduction of wage incentive systems, thus securing more saleable product with the same fixed expense.

2. Weeding out obsolete and worn-out equipment.

3. Scheduling operations to the most economical equipment.

4. Keeping equipment in the best possible condition.

5. Providing adequate floor space around the machine for handling materials easily and quickly. Floor space is cheaper than the wages of an operator and the overhead of a machine.

6. Seeing that the operator is experienced and has a natural aptness for the operation entrusted to him.

7. Providing facilities and men to handle materials, so the operator may keep the operating facility busy.

WASTE OF MATERIALS

Waste of maerials can be caused by an number of things. Among the most common are:

1. Paying too much for the materials, because: a) The buyer does not keep in touch with the market. b) Faulty stock records do not furnish the buyer with information concerning the needs of the shop soon enough to allow him to buy at the lowest price obtainable.

2. Faulty specifications, causing: a) the expense of reordering materials; b) the cost to put accepted defective materials in useable condition; c) the extra cost of processing and assembling because materials were the wrong size or grade; d) rejection of finished product because materials were not right; e) delayed production pending receipt of reordered materials.

3. Production: a) wrong instructions from engineering department; b) wrong instructions from supervising foreman; c) defective stock; d) inexperience or carelessness of operator; e) faulty operating facility; f) poor working conditions.

4. Overbuying: a) market price reductions after stock was purchased; b) deterioration of materials; c) obsolescence; d) housing cost; e) interest on investment.

WITH OVERHEAD ON MACHINE RATES

A—PRODUCTION CENTER NUMBER
B—HOURS
C—WAGE RATE
D—COST PER HOUR (wage rate)
E—TOTAL COST

(A)

	A	B	C	D	E
FORGE	6	100	$ 1.50	$ 5.98	$ 598
TURN	11	130	1.25	2.78	361
FACE	20	150	1.10	2.65	394
GRIND	19	90	.90	1.79	161
BENCH	50	70	1.00	2.06	144
TOTAL		540			1,658

WITH OVERHEAD AS PERCENT OF DIRECT LABOR

A—HOURS
B—WAGE RATE
C—LABOR COST
D—DEPARTMENT
E—PERCENT OF OVERHEAD TO LABOR
F—OVERHEAD COST
G—TOTAL COST

(C)

	A	B	C	D	E	F	G
FORGE	100	$ 1.50	$ 150	A	200%	$ 300	$ 450
TURN	130	1.25	163	B	100	163	326
FACE	150	1.10	165	B	100	165	330
GRIND	90	.90	81	C	90	73	154
BENCH	70	1.00	70	B	100	70	140
TOTAL			629			771	1,400

(B)

	HOURS	HOURLY RATE	COST
FORGE	100 X	$ 5.98 =	$ 598
			361
5 MULTIPLICATIONS			394
			161
			144
1 ADDITION			1,658
6 CALCULATIONS			

(D)

	HOURS	LABOR RATE	LABOR COST	O.H. RATE	O.H. COST	TOTAL COST
FORGE	100 X	$ 1.50 =	$ 150	X 200% =	$ 300	
			163		163	
10 MULTIPLICATIONS			165		165	
			81		73	
			70		70	
3 ADDITIONS			629	+	771 =	$ 1,400
13 CALCULATIONS						

CONCLUSIONS

1—OVERHEAD DISTRIBUTED TO JOBS ON THE BASIS OF MACHINE RATES IS SOUND PRACTICE
2—OVERHEAD DISTRIBUTED TO JOBS ON THE LABOR BASIS PRODUCES UNRELIABLE COSTS
3—OVERHEAD DISTRIBUTED TO JOBS ON THE MACHINE RATE BASIS TAKES LESS TIME

EXAMPLE OF VARIANCE IN A JOB COST CAUSED BY USING DIFFERENT OVERHEAD METHODS

COMPARISON of the number of operations required to develop costs or estimates reveals that machine rates require only 6 calculations, while 13 are needed if overhead is applied as a percentage of direct labor. Results differ, as machine rates are more accurate

Here are the five most commonly used methods of applying overhead

$$\frac{\text{TOTAL FACTORY OVERHEAD}}{\text{TOTAL DIRECT LABOR}} = \%\ \text{OF LABOR}$$

$$\frac{\text{TOTAL FACTORY OVERHEAD}}{\text{TOTAL DIRECT HOURS}} = \text{PER HOUR}$$

$$\frac{\text{DEPARTMENT OVERHEAD}}{\text{DIRECT LABOR}} = \%\ \text{OF LABOR}$$

$$\frac{\text{DEPARTMENT OVERHEAD}}{\text{DIRECT LABOR HOURS}} = \text{PER HOUR}$$

$$\frac{\text{COST CENTER OVERHEAD}}{\text{OPERATING HOURS}} = \text{PER HOUR}$$

DIFFERENCE IN THE COST of operating various machines or machine combinations in a department cause greatly differing percentages of overhead to direct labor. Note the variation of actual percentages around the average for each of the cases shown. Consider, too, what the effect will be on cost if the same overhead rate is used for each operation in a department

WASTE OF LABOR

The profit advantages of measuring and controlling wasted labor in industry is generally accepted by management and accountants. Manufacturers have realized for some time that some sort of labor standards must be set for individual operations, so they may measure the efficiency of individuals to whom jobs are assigned.

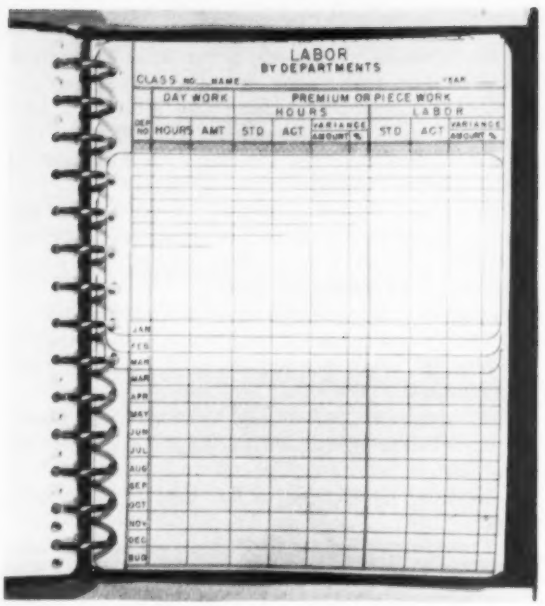
There are three common wage payment plans: 1) straight hourly wage; 2) bonus or premium; and 3) piece work. Regardless of the method of establishing standard or allowed time on individual operations, the placing of this information in the hands of the operator has a decided stimulating effect on the personnel of the department. Anything that will influence operators to reduce the working time on a job contributes to the elimination of wasted capital expenses, direct labor and current expenses.

If management is to reduce wasted capital expenses, materials, labor and overhead, it must have information that is timely, accurate and complete.

HOW COSTLY ARE MACHINE RATES?

Now comes the $64 question. How much more does it cost in clerical effort to apply overhead costs on a machine rate basis than by using either departmental or plant averages? First, there is the additional cost of establishing the rates. Much depends on the amount and quality of basic information available. Having fairly adequate information, the author established normal hourly operating costs for 250 machines in 15 days. In another machine tool plant, with better basic information at hand, it required only 11 days to establish rates on 400 machines. This expense, therefore, is not great.

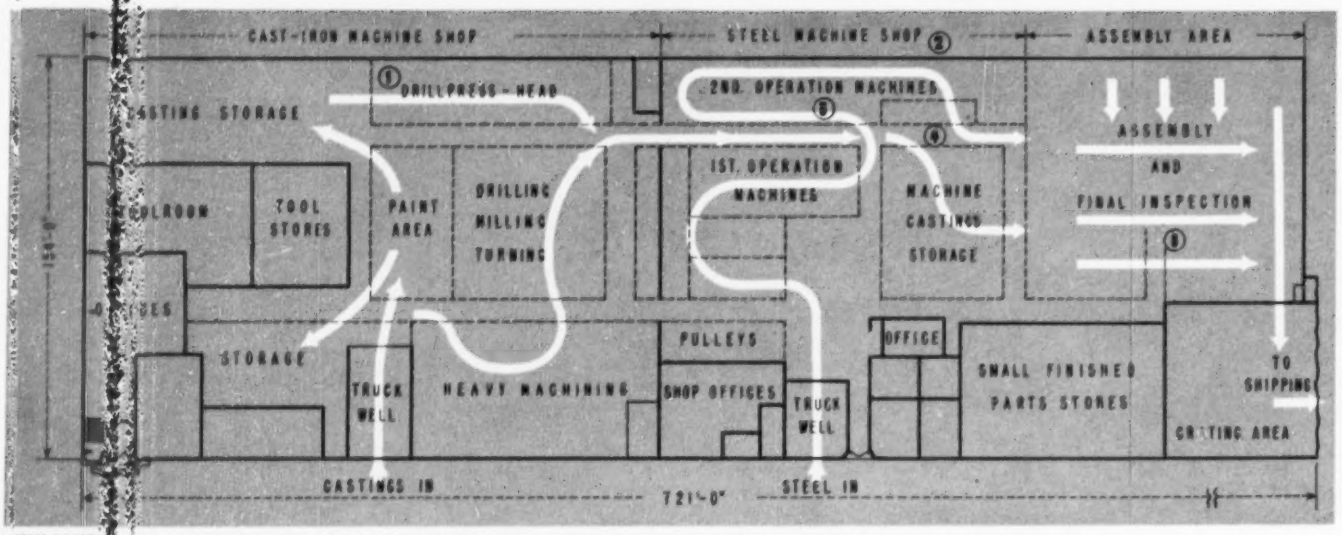
One machine tool builder, who changed from a system of allocating overhead on a blanket percentage of direct labor, to a machine rate basis, found it necessary to increase cost department personnel from five to five and one-half, or approximately 11%. This is a relatively small additional expense to insure dependable cost figures.



CONTROL OVER LABOR COSTS is excercised through two types of information, **labor by classes** (see page 153), and this form, **labor by departments.** Departments are listed at left, and lapping permits accumulation of all monthly reports for a year in the same place

PROFIT AND LOSS, BY CUSTOMERS, is the same basic form as that shown for **sales units** (page 152). Control data are in comparison of actual vs standard profit, at right. This shows a year's business with a particular customer, in one series of lapped cards

The success of any manufacturing organization depends, to a large extent, on good merchandising, and good merchandising must be predicated on sound costing. Therefore, the cost acountant's function is to produce the facts and figures that will enable management to perform the tasks of organization, management, and administration with the utmost facility.



NEW LAYOUT provides direct-line flow of work in plant where production is primarily job-lot. Castings come in at east dock, are painted immediately, and go into storage. Virtually all machining on castings is concentrated in the cast-iron shop. Bar stock comes in at west dock. Automatics, grinders, threading machines, and all equipment required for steel jobs is located in the area served by this dock. Parts flow to assembly areas at right and then in a direct line to the shipping area, which was omitted from this layout. The numbers are the key to pictures and detail layouts which follow. Layout reduces congestion and material movements

1 LINE PRODUCTION SETUP . . . Two si move through machines lined up progre each size are located on opposite sides of of 3-wide conveyor for storage. Progress machines. New method simplifies difficult

RE-LAYOUT BETTER HANDLING IMPROVED METHODS

SAVE $200,000 per year

20% more production from 40% less space is the pay-off from a program of plant modernization at Walker-Turner. Inventory is halved, turnover has more than doubled, and operating costs are cut almost a quarter-million per year

BY WILLIAM F WILSON, Works Manager, WALKER-TURNER DIVISION, KEARNEY & TRECKER CORPORATION

Two years ago, Kearney & Trecker's Walker-Turner Division was operating in two buildings. One was a multi-story plant of approximately 140,000 sq ft. Most machining operations were carried on at this location. Assembly was performed in a single-story building about a block distant. All production had to be transported from one building to the other. Within the plant, machines were arranged with little regard to establishing a smooth flow of work through the shop. Layout was poor, aisles were narrow, and material movement slow and difficult.

Today all manufacturing operations are consolidated into the one single-story building. The same output that formerly required 220,000 sq ft of floor space now is turned out in 120,000 sq ft. In fact, present productive capacity is at least 20% greater than it was, despite the 45% reduction in floor area. Inventories have been cut in half, the manufacturing cycle has been greatly reduced, and operating costs have been reduced by almost a quarter-million dollars per year.

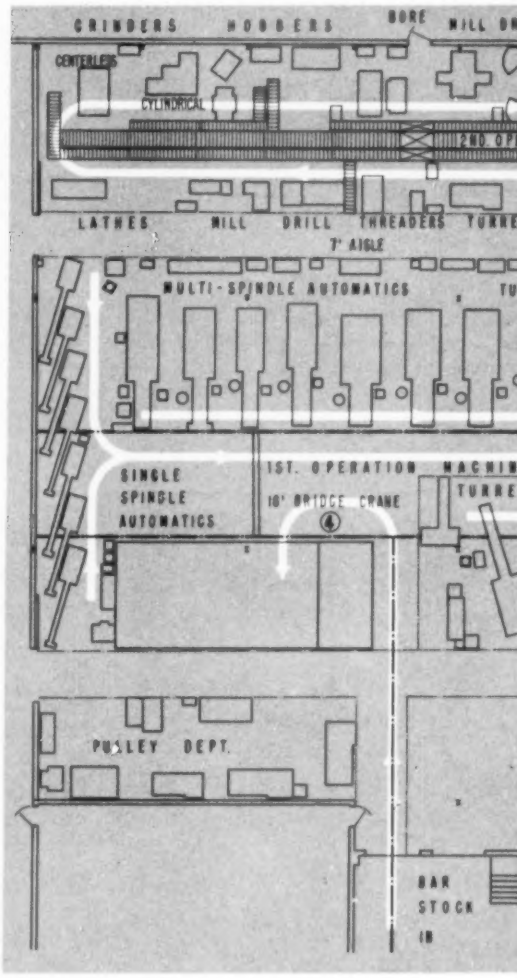
How was this done? By taking an over-all view of our manufacturing operations and developing a plant-wide program that involved re-layout, better handling, and improved methods. Within this framework, a number of supporting changes had to be made.

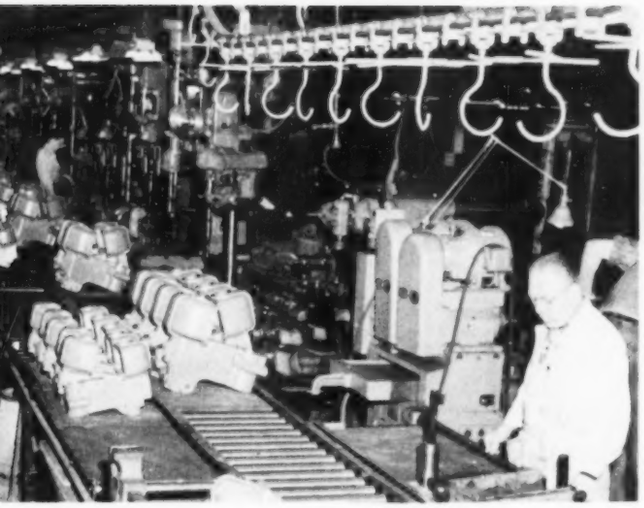
It was necessary for example, to install a completely new electrical distribution system with triple the former capacity. Additional handling facilities were required and, in one case, a door opening was knocked through a solid wall to permit direct-line flow of material from one area to another. However, the total cost of the project, exclusive of a 30,000-sq ft building addition and several new machine tools, will be paid off in less than a year from the savings.

MACHINE UTILIZATION STUDY

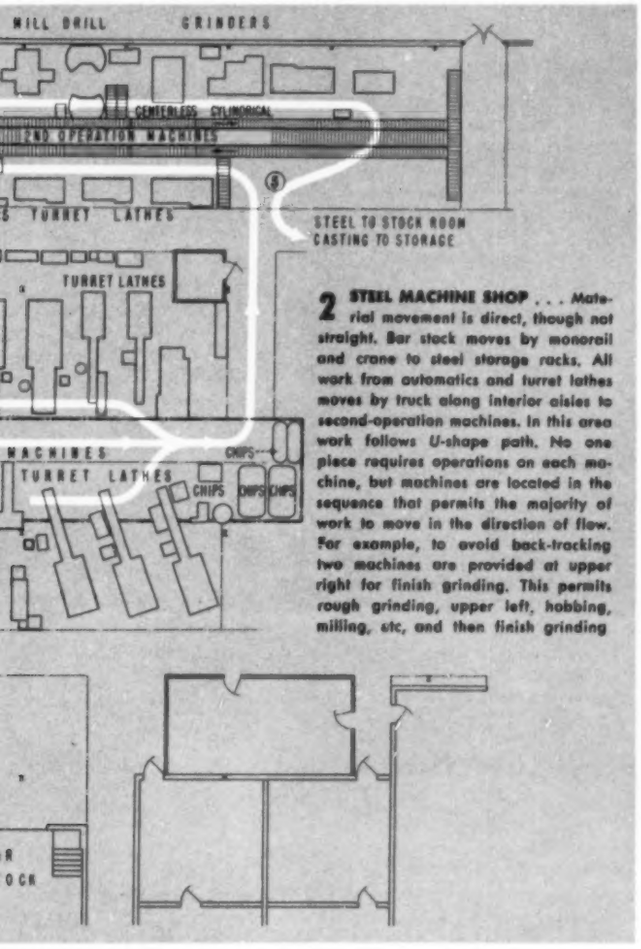
The first step in our program was a study of machine utilization. Operation sheets were checked and actual operating hours for each piece of equipment were determined. As a result, several machines that were used very little during the year were sold and the operations involved were transferred to other equipment capable of performing the same work.

Next we tackled the problem of layout. This was complicated by our desire to use existing buildings and to hold new construction to a minimum. It was further complicated by the fact that we are predominantly a job-shop operation. The production of light drillpresses, band saws, and other machines for metal-working and woodworking operations does not involve quantities that permit permanent setups and steady-running jobs in most instances.

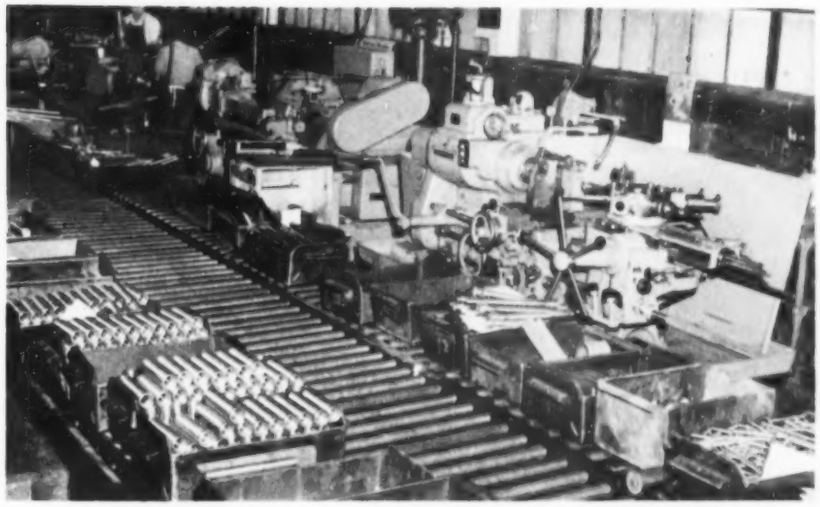




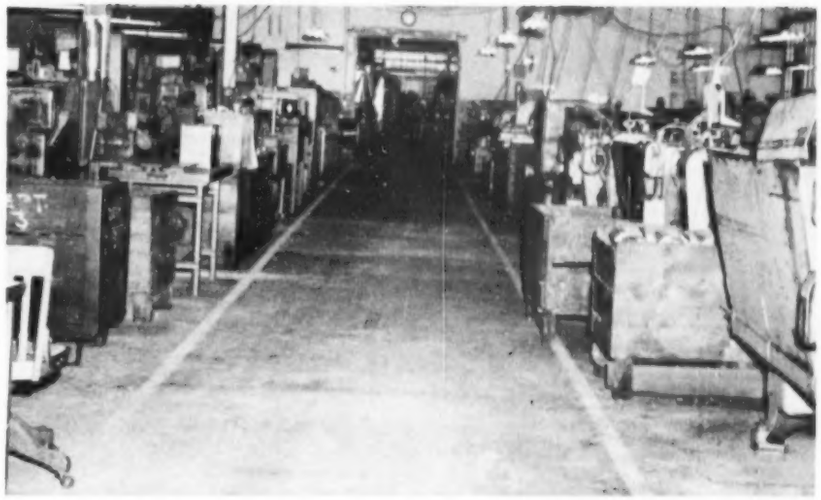
. . Two sizes of drillpress heads are machined complete as they up progressively on both sides of roller conveyor. Machines for e sides of conveyor. Castings move on pallets with center section . Progressive setup replaces machining in lots at individual s difficult handling problem and triples former production rate



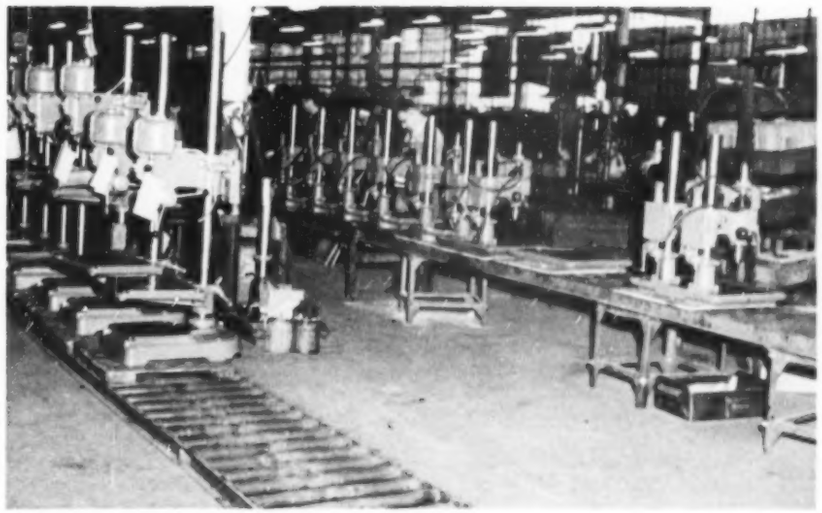
2 STEEL MACHINE SHOP . . . Material movement is direct, though not straight. Bar stock moves by monorail and crane to steel storage racks. All work from automatics and turret lathes moves by truck along interior aisles to second-operation machines. In this area work follows *U*-shape path. No one piece requires operations on each machine, but machines are located in the sequence that permits the majority of work to move in the direction of flow. For example, to avoid back-tracking two machines are provided at upper right for finish grinding. This permits rough grinding, upper left, hobbing, milling, etc, and then finish grinding



3 CONVEYORIZED MISCELLANEOUS MACHINING . . . Roller conveyors move tote pans of work through second-operation machining area. Machine arrangement is based on operation sequence of 45 major product items that comprise approximately 50% of the volume flowing through this area. These parts never backtrack. Conveyors are Lamson heavy-duty roller sections

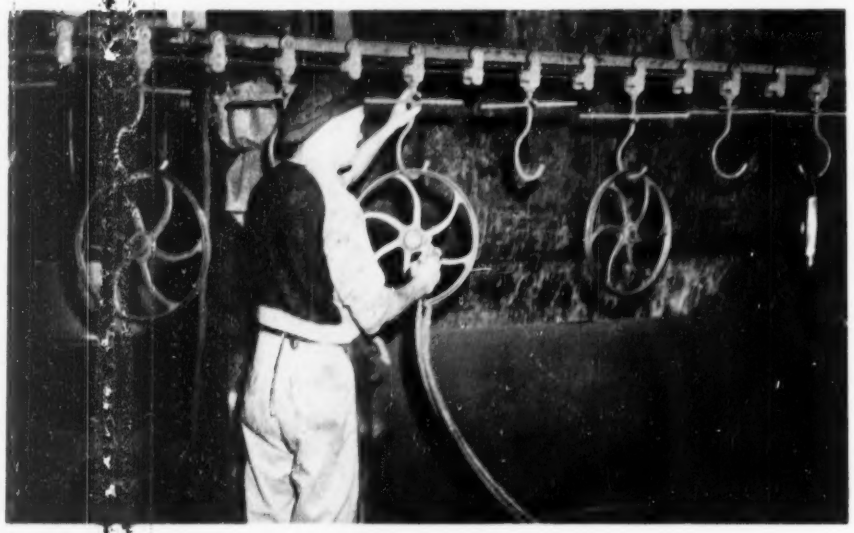


4 MAIN AISLE . . . Two seven-foot aisles run full length of plant, permitting fast movement of material from area to area and improving plant housekeeping. View was taken in steel shop with conveyorized second-operation machining area at right

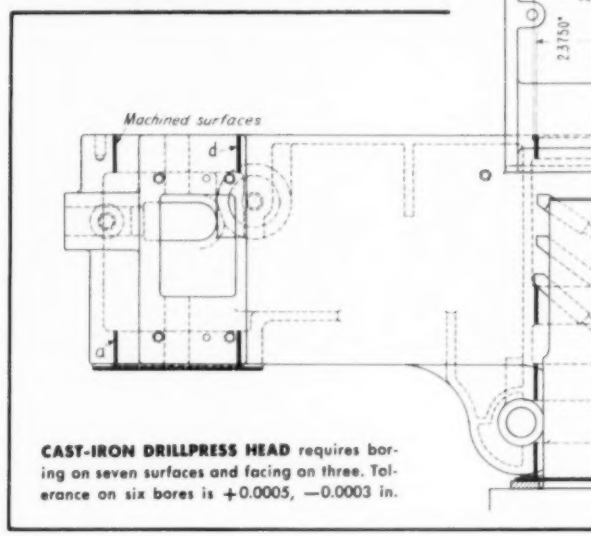


5 ASSEMBLY LINE . . . For easier handling and a cleaner, neater assembly area, drillpress assembly is performed on roller conveyors. Floor models are assembled on base of crate. Crating is completed on second conveyor at right angles to assembly line. Bench models, right, go into cartons, which are palletized. Crates and cartons are carried to storage and shipping areas by fork-lift truck

IMPROVED METHODS BOOST PRODUCTION, BREAK BOTTLENECKS...



DOUBLES CAPACITY . . . Hot spray painting system is directly opposite receiving dock. All in-coming castings are painted immediately. Painting upon arrival eliminates costly masking operations formerly required when castings were painted after machining. Paint is pre-mixed synthetic enamel sprayed at approximately 150 F. Hot painting gives thicker coat, quicker drying, and eliminates need for thinner. Castings air-dry in 20 minutes. Tunnel at right takes off all fumes from painting



CAST-IRON DRILLPRESS HEAD requires boring on seven surfaces and facing on three. Tolerance on six bores is +0.0005, —0.0003 in.

We felt, however, that it might be practical to set up some of our drillpress items for line production and that, in general, it should be possible to obtain a layout in which the greatest percentage of our work flowed from one end of the building to the other with a minimum of backtracking. With this in mind, we laid tracing paper over our existing layout and charted the movement of material from operation to operation for a number of our major production items.

FLOW DIAGRAMS

These flow diagrams showed the reasons for the excessive handling and congestion that were choking our productive capacity and increasing our operating costs. In some cases, parts were moving in and out of the same area as many as three times, with movements of as much as 200 ft between operations. At the same time, it became obvious that a basic change in method would be necessary in some cases to obtain production flow, lower in-process inventory, and a shorter manufacturing cycle.

Drillpress heads, for example, were being produced on radial drills with seven separate setups required to complete one piece. By the time one lot was completed, four days had elapsed from the time the job was started. Retooling for line manufacture now makes it possible to complete a head within 20 minutes after the casting reaches the first operation. Handling is no problem, and inventory is down approximately 60%. How this was done and how a number of other methods improvements were made is explained in detail later in this article.

FIRST, AN IDEAL LAYOUT

Having settled upon our manufacturing methods, we then drew up an ideal layout – the one that we would like to have if we could afford an entirely new plant. With this as a guide, we then laid out our existing single-story plant to approach our ideal as nearly as possible. To complete the layout and put all operations formerly housed in two buildings into the one single-story plant, it was found that 30,000 sq ft of additional space was needed. Approximately 60% of this total is office space.

In the new layout, we actually have two separate shops, one for cast-iron, the other for steel. While some parts require machining in each shop, these make up a very small percentage of our total production. Castings come in at one receiving dock, bar stock at a second.

Castings are painted immediately after arrival. This is one of our major methods changes. Previously castings were painted after machining. Plugging and masking was time-consuming, and the flow of work from machining back to painting created unnecessary back-tracking and congestion.

Our paint facilities now are directly opposite the receiving dock for castings. An overhead conveyor carries castings through a paint booth and a ventilating tunnel that carries off all fumes while the pieces are air-drying. We also have gone to hot painting. We not only get a better-quality paint job, but also can use pre-mixed paints, eliminating the use of thinner – something that we feel is highly desirable now that our painting operation is right out on the production floor rather than in a separate room as it was in our old layout.

DIRECT-LINE FLOW OF WORK

After painting, castings move into storage. This can't be avoided because foundry lot-sizes are much larger than those we put through the shop. Drillpress heads are set up for line manufacture. The rest of the cast-iron shop, however, is layed out on a process basis – all milling machines in one area, and so on. However, the arrangement – Blanchard grind, mill, and drill – parallels the operation sequence on most of our castings.

Furthermore, within each area there are some machines on which certain major items make up an appreciable percentage of the load. These machines are located to permit short direct movements from one machine to the next. The same principles of machine-group location and of machine arrangement for good flow on at least all major items, have been applied in the steel machine shop. In this way, the overall material flow through the shop, for the most part, is in one direction. Backtracking and cross-hauling has been greatly reduced. Congestion is no longer a problem.

MECHANIZED HANDLING

To provide swift, easy movement of materials, two main aisles, seven feet wide, run the full length of the plant. While there was some suspicion at first that these might be wider than necessary and hence wasteful of space, they have proved to be just nicely adequate. No side aisles are less than four feet wide.

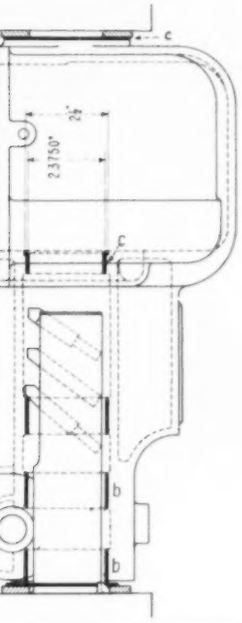
Hand lift trucks do most of the handling in the cast-iron shop. Fork trucks are employed for all handling in the storage and shipping area, as materials are stacked in these areas to take full advantage of building volume. Roller conveyors are working out nicely on the drillpress-head line, in the second-operation steel machining area, and in assembly.

A major improvement has been effected in our steel handling methods by addition of the monorail and overhead crane system. Throughout the plant, where any heavy pieces must be lifted, we have hoists or jib cranes.

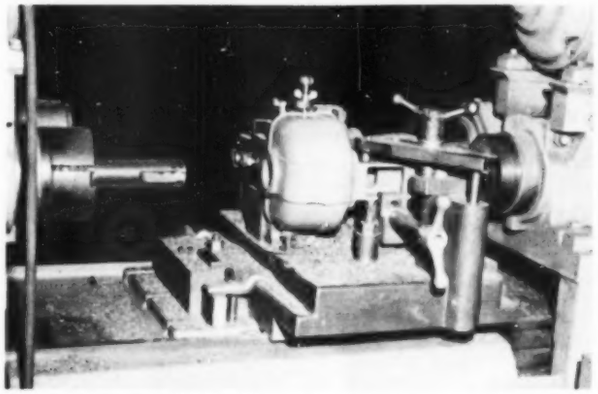
To obtain the economies that we were after, no one change alone was enough. Consolidation eliminated the trucking between plants, reduced the amount of supervision required, and cut other overhead costs appreciably. But proper layout and good handling were equally important in obtaining effective utilization of available floor space and in realizing the productive capacity of our machine tools and equipment. In addition, we must have good production scheduling to keep manufacturing efficiency high.

GENERAL PLANT SERVICES

We also are not under-rating the importance of service facilities and working conditions. When we set up our new paint system, we moved our compressors right alongside the spray booths so the air supply is close to point at which most of it is used. While our present layout is a vast improvement, we do not expect it to remain static. Bus duct throughout the plant gives us the flexibility that we need for



. . . NEW PRECISION BORING METHOD TRIPLES PRODUCTION



PRECISION BORING MACHINE rough- and finish-bores and finish-faces drillpress heads in one operation. Castings formerly were roughed in one setup, finished in a second. A separate operation was required for facing. Former output was 10 pc/shift. New setup turns out 45 pc in same period

SPECIAL BORING BAR has facing cutters spaced unequally around periphery. Cutters also are set for negative radial rake. These features reduce chatter during facing

To step up output on 20-in. drillpress heads, new tooling and methods were developed for precision boring and facing operations. A new double-end Ex-Cell-O now turns out more than three times the output formerly obtained from a 12-year old machine of similar design. While similar, the old machine lacked sufficient horsepower to permit tooling of the kind now employed.

In the new setup, the machine table traverses left, then changes to feed rate to bore bearing surfaces *a* and *b* simultaneously. A second tool begins to finish bore these surfaces as soon as the roughing tool completes its cut. To make it possible to rough and finish boring in one setup, the casting has been designed to provide a recess after each bearing surface. This recess is ⅛ in. longer than the cut. The roughing tool, therefore, is not in contact with the casting while the finishing tool is working.

Just as boring is finished, the machine changes its feed rate and three additional tools come into action. These face and chamfer the ends of the drill-spindle and drill-column holes. The spindles then stop and the table rapid-traverses to the right into position for boring and facing surfaces *c* and *d*.

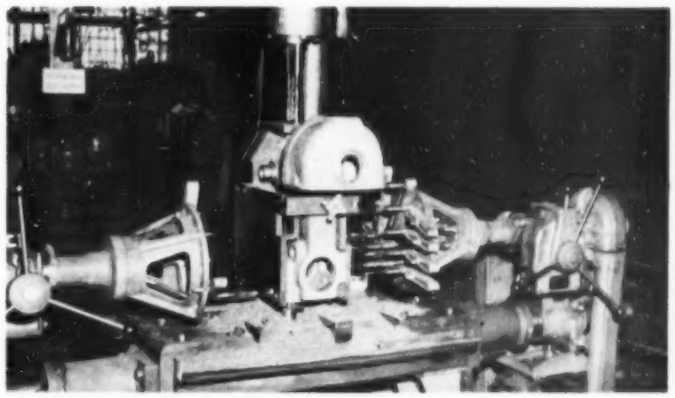
As the casting is less rigidly supported at this end, some chatter developed during facing. Staggered cutter spacing and negative rake brought this condition within acceptable limits. The rake angle provides a shearing action and directs the chips out away from the boring bar.

All tools are carbide tipped, grade 883, and are run at 300 sfpm.

future layout changes.

Fluorescent lighting is provided throughout the plant, with general illumination approximately 35 footcandles for average machining and assembly work. However, at inspection areas and on machines performing close-tolerance work, intensities range between 80 and 100 footcandles. At present, we are experimenting with the Pittsburgh Dynamic Paint color scheme on our machine tools. Our toolroom now is painted according to Pittsburgh recommendations. If we find that the benefits are enough to justify the expense, we'll paint the entire shop the same way.

We feel that to obtain top operating efficiency we must look at the over-all picture, considering all factors affecting the manufacturing operation. On top of that, improvement is a never-ending job. We've taken a long step forward in modernizing and streamlining our facilities but we have a great deal yet to do. The possibilities in modern equipment and better methods are virtually without limit.



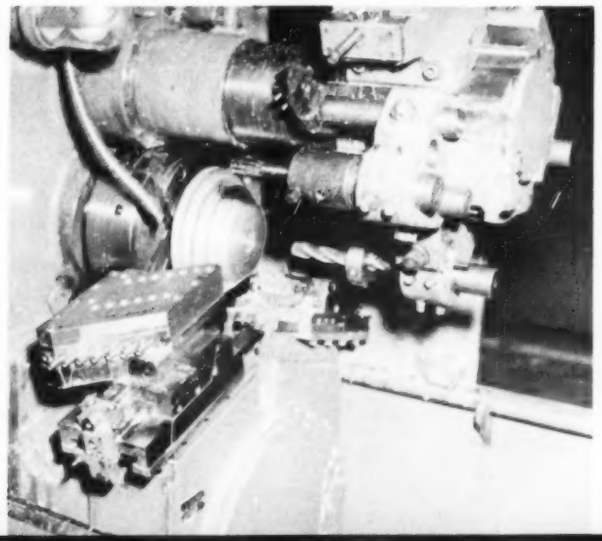
VERSATILE DRILLPRESSES provide special-machine economy with low capital investment. Three Walker-Turner 20-in. drillpresses are arranged to drill 11 holes simultaneously in three planes of drillpress-head casting

SPECIAL DRILLING SETUP CUTS TIME 65%

Drillpress heads formerly were machined in seven different fixtures on radial drills. An entire lot was run through before changing the setup. Now drillheads have been arranged for progressive manufacture. Pieces move on pallets over roller conveyors from machine to machine. In addition to standard equipment, this line includes three special setups of the type pictured.

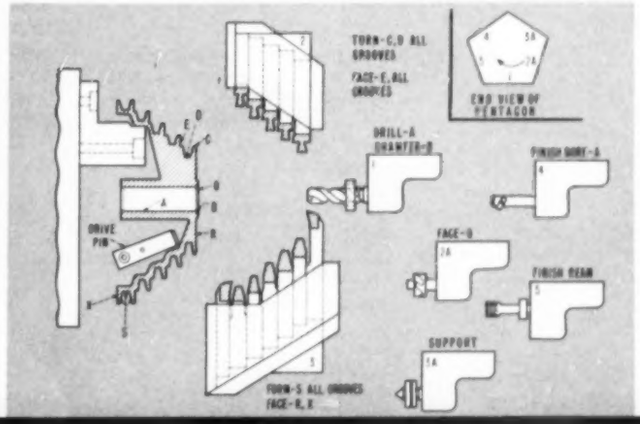
Standard Walker-Turner drillpresses are arranged to permit multiple drilling in three planes simultaneously. In some cases, the standard power feed of the drillpress is used. In other cases, air feeds are employed to give an automatic cycle, including rapid traverse, feed (with drill withdrawals if necessary), and return. With this setup, one operator tends two or more machines, moving back and forth along the line. Production is up at least three times, in-process inventory is down and the manufacturing cycle has been cut from days to hours.

. . . AUTOMATIC CHUCKER BOOSTS OUTPUT 400%



CAST ALUMINUM PULLEY is machined in less than three minutes on new Warner & Swasey No. 1-AC chucker. Job formerly required two turret-lathe setups plus a broaching operation. Output was 5 per hour

TOOL LAYOUT shows operations, sequence, and surfaces machined. Job was tooled complete by Walker-Turner



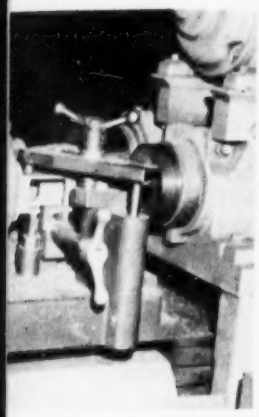
Drillpress pulleys now are run on a new automatic chucker at four times the previous rate of production. The pulley bore is held to +0.0005, —0.0 in. Grooves are held concentric to the bore within 0.004 in. total.

As the pulley is a light sand-cast aluminum alloy, special jaws, much wider than usual, are employed to avoid distortion. Forming tools are standard toolbits, ground as required for gang mounting in the cross-slide toolblocks.

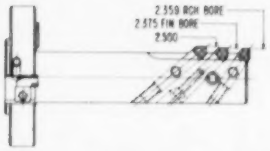
To speed tool changes, forming tools are set to a templet. Fine adjustment screws are provided in each toolbock. To minimize breakage in handling, tools are tipped with grade 44A which withstands wear very well yet is less brittle than other acceptable grades. Forming is performed at 1000 sfpm and 0.006 ipr.

At position 1, a special collar attached to a standard core drill chamfers the pulley bore. Position 3A contains a special spring-loaded support that engages the bore during finish-forming of the grooves (cross-slide, position 3). During the automatic cycle, the operator faces the back of the pulley hub on a drillpress alongside the chucker. Thus a complete pulley is produced in the time required for one automatic cycle.

ING METHOD TRIPLES PRODUCTION



d finish-bores and finish-faces formerly were roughed in one eration was required for facing. turns out 45 pc in same period



SPECIAL BORING BAR has facing cutters spaced unequally around periphery. Cutters also are set for negative radial rake. These features reduce chatter during facing

To step up output on 20-in. drillpress heads, new tooling and methods were developed for precision boring and facing operations. A new double-end Ex-Cell-O now turns out more than three times the output formerly obtained from a 12-year old machine of similar design. While similar, the old machine lacked sufficient horsepower to permit tooling of the kind now employed.

In the new setup, the machine table traverses left, then changes to feed rate to bore bearing surfaces *a* and *b* simultaneously. A second tool begins to finish bore these surfaces as soon as the roughing tool completes its cut. To make it possible to rough and finish boring in one setup, the casting has been designed to provide a recess after each bearing surface. This recess is ⅛ in. longer than the cut. The roughing tool, therefore, is not in contact with the casting while the finishing tool is working.

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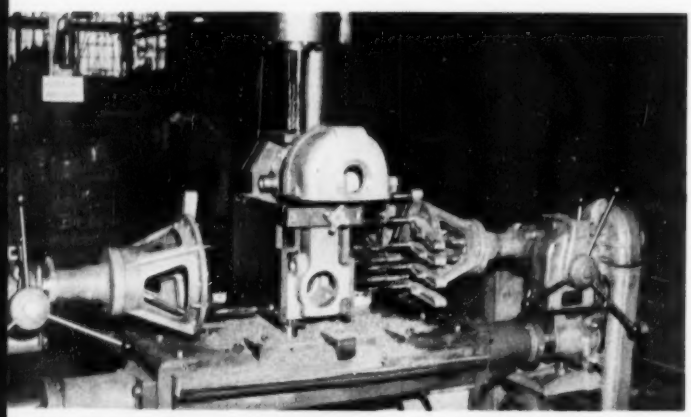

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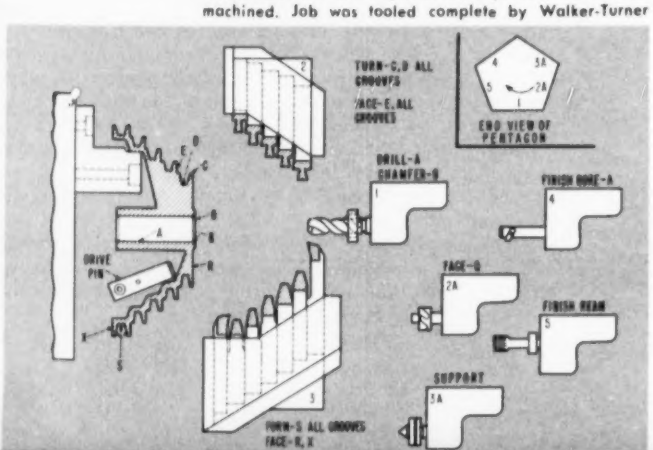

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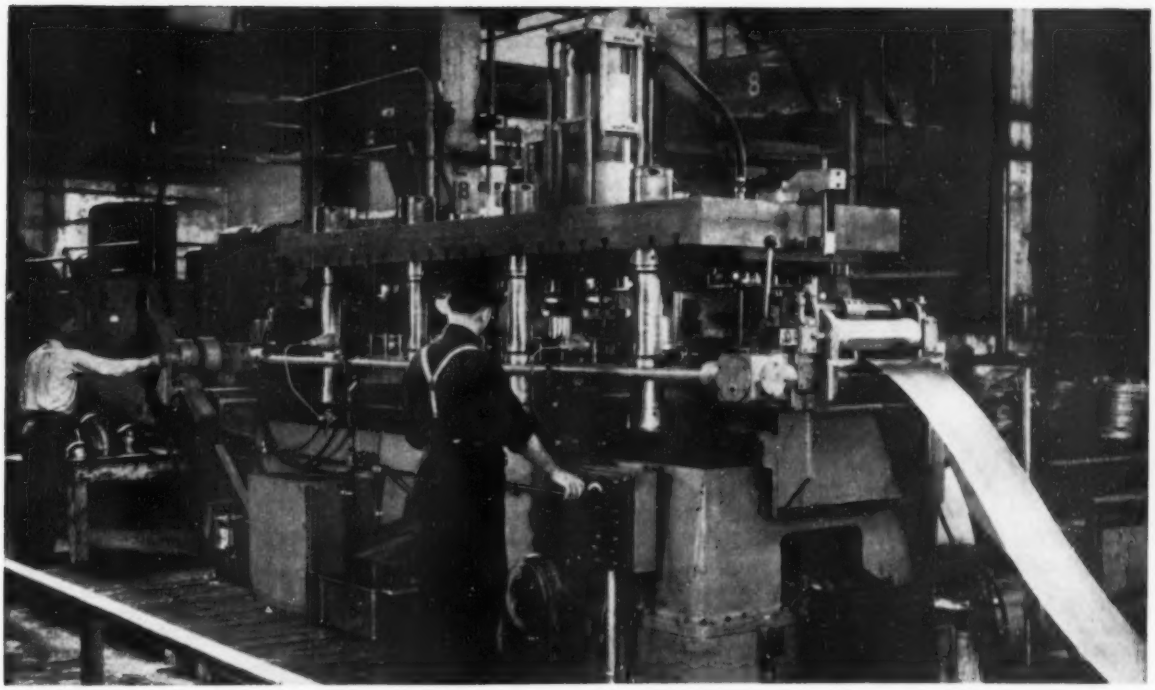
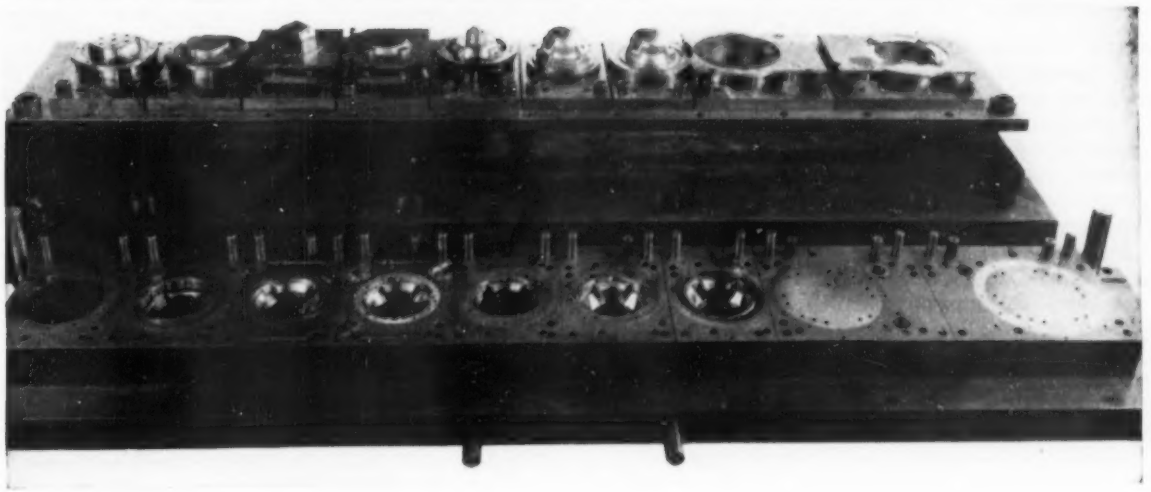




Ford makes headlight liners in progressive dies

FOR THE past two years, Ford Motor Co, Monroe, Mich, has been using 9-station, sectional progressive dies in 350-ton "upside down" dieing presses to make headlamp liners. Strip stock is 0.042 x 13 in. CR low-carbon steel. Presses run at 24 strokes per min; each produces 5300 pcs in 8 hr because of stoppages to change stock reels, etc. Variable-speed drives on the presses enable setting speed to suit job characteristics.

Use of progressive dies in dieing presses (these machines take tools up to 28 in. wide by 150 in. long and provide 14-in. stroke) means that Ford can put men on jobs where they are badly needed. With the old system of using single-operation tools in upright crank presses, 21 people were needed on a 3-shift basis. Now only 6 men serve the dieing machines.

Maximum depth of draw for the headlamp liners is 5½ in. Drawing is done against air cushions on top of press, where they are easy to service. Strip is raised and lowered by disappearing lifter pins and advanced by roll feed. Limit switches must be tripped by the pins, or the press will stop. Holes are pierced by cam-operated punches. Ford has ordered four more similar presses for other jobs. These machines have 8 pullrods instead of the conventional 4 and 2 crankshafts.

Developed to beat the manpower shortage, here's how Carboloy's ...

THREE-STEP PLAN TRAINS NEW SUPERVISORS

BY ROBERT G BRIERLEY
Manager of Training
CARBOLOY DEPARTMENT OF GENERAL ELECTRIC

1 GENERAL TRAINING ... Candidates for supervisory positions work in each major section of the company (marketing, finance, etc). This phase gives them a broad background of company operations. Candidate Dave Benedict worked on the drafting board during part of his stay in Engineering

Since 1950, industrial management has found it increasingly difficult, and, in some cases, practically impossible, to find and train men to assume positions of responsibility. At Carboloy, the General Training Program is solving crucial manpower problems by providing a continuous flow of trained personnel for positions of responsibility in all fields of company activity.

Machine tool and tool and die companies have long trained skilled workers through their apprentice programs. Such programs provide a concentrated period of both broad and specialized training in each phase of the work in which the trainee may eventually be assigned. Why not apply the same principle to the training of men with a capacity for growth into management positions? This theory, essentially, is embodied in Carboloy's program.

How Is the Program Set Up?

The program is divided into three phases. Phase one is a general period lasting 32 weeks. Trainees spend from one week to a month in each major department of the company—Marketing, Manufacturing, Employee and Plant Community Relations, Finance, and Engineering. This gives them a solid foundation and understanding of the company's business—something that is a necessity in today's complex business structure.

Phase two is spent on special project assignments in the section in which the trainee ultimately expects to work. This period lasts six months. Phase three, also six months, is intensive on-the-job training.

During the first phase, weekly training sessions go into detail on such subjects as company organization, letter writing, conference leadership, dictophone use, and visual aids. Speeches are given and reports prepared. This period is the "general training" phase.

How to Get Flexibility in Training

Flexibility, which allows men to train for sales, manufacturing, engineering, or personnel is achieved through the specialization of phase two. Men who are pointing toward Manufacturing spend a great deal of time in the shop. No formal plan for meeting with shop personnel is followed. However, trainees are urged to get into the shop and make the most of their opportunity to get together with people who have years of experience.

During phase three, the trainee works as assistant to the man who is doing the job he is understudying. If, for example, a man were slated to become a foreman in manufacturing, he would be assigned to work as an assistant to one of the foremen, actually doing the work himself under the careful supervision of the foreman. This would include taking a turn at *all* the foreman's duties from listening to employee problems to overseeing manufacturing procedure.

At the completion of this phase, the trainee is considered capable of stepping in and taking over a job similar to the one he has been learning. The trainee does not shift around in this phase. He concentrates on one particular job that parallels the one to which he ultimately will be assigned. This conceivably could cover practically any assignment in the plant, including manufacturing engineering, tool room, machine repair, or tooling sections.

At an early stage of the course, K R Beardslee, general manager, and each department manager, join the trainees in the company cafeteria for coffee. As long as three hours may be spent discussing points of special interest to the potential supervisors. Car-

2 **SPECIALIZATION** . . . Phase two provides experience in the field in which each candidate will work. Dave, slated for Manufacturing, spent most of his time in the shop. Here, he works with an inspector on the carbide masonry-drill line

3 **ON-THE-JOB TRAINING** . . . Phase three concentrates on the specific job the candidate will be given. Dave, for example, assisted a foreman, taking a turn at all duties, and actually working on machines. Later, Dave will supervise people working on operations such as the one he is shown doing

boloy favors this approach over formal meetings as a method of introducing a new group to the people for whom they eventually will be working.

Proper selection of men for the program is vital. Trainees usually are graduates of engineering colleges. However, a few men with arts degrees have been accepted when their background showed definite aptitude and interest along mechanical lines. In most cases, men starting the program are recent college graduates, but some have had a few years' experience in the business world.

Steps in Selecting Trainees

Selection falls pretty much into these steps:

1. Preliminary interviews are held in colleges and, where appropriate, invitations to visit the plant in Detroit are extended.

2. At the plant, further interviews are scheduled with the manager of personnel, and the manager of the particular department in which the individual might wish to be assigned. In some cases, the individual has the opportunity to meet his immediate superior, when it is possible to know that far in advance that an opening is coming up.

3. Information is collated from each of the interviewers and an offer is made to the individual.

4. Where records (college background, previous aptitude test results, etc) are not complete, thorough interviewing and aptitude testing is arranged with a professional guidance counselor. These tests take two days, five hours of testing in each. They include mechanical aptitudes, general intelligence, motor reactions, and so on.

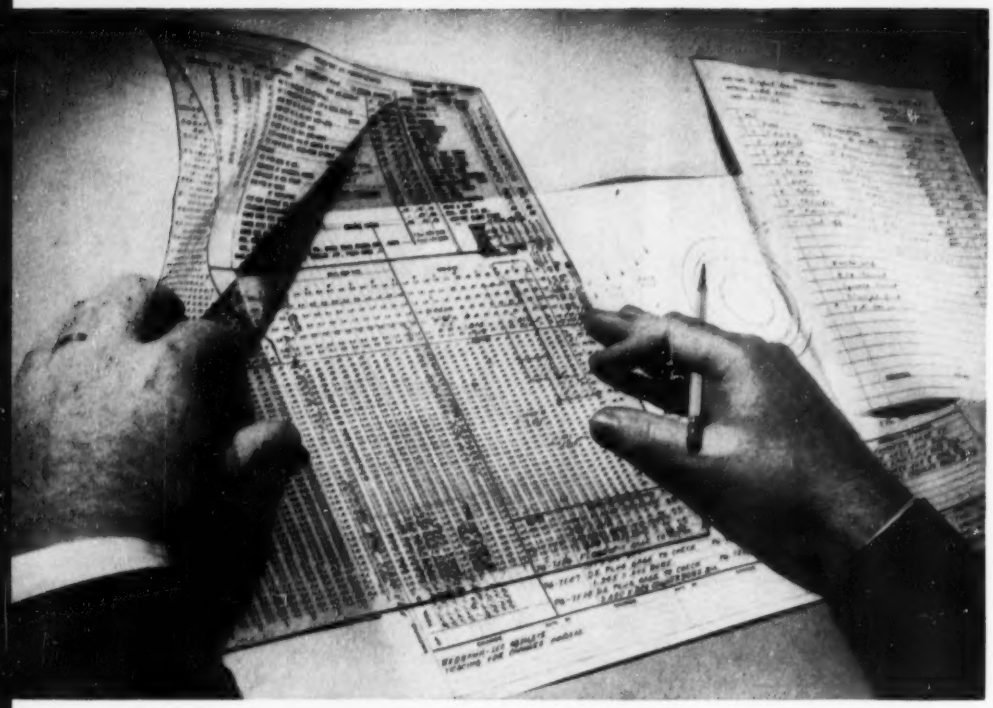
At the completion of the tests, the individual is told of the results by the counselor and the results then are turned over to Carboloy. These are used periodically during the training program as an aid in locating particular areas where a trainee may need special training. With these tests as a yardstick, tailor-made courses and instructions are given to help each individual in the way he most requires assistance. The tests also are used by section heads and personnel people in later placements, selection for jobs, and so on.

When started in 1946, this training program was considered merely as a more effective way to train salesmen. Later, when Carboloy became a department of the General Electric the general training program was extended to include trainees for manufacturing, engineering, sales engineering, and personnel. The inclusion of these trainees was a direct result of the tremendous success of the program in the sales field.

"The proof of the pudding . . ."

Dave Benedict (who appears as a trainee in the accompanying picture) now is working as foreman in metal mixing, a basic phase of the Carboloy operation. He is in charge of about 60 men and in general, is responsible for the entire operation of the department.

All "graduates" have an excellent general foundation and understanding of all phases of the business. Management agrees wholeheartedly that graduate trainees are successful and that the company benefits immeasurably from their services. According to Kenneth R Beardslee, general manager of Carboloy Department: "We believe that our training program is helping us fulfill the vital trained manpower gap that is plaguing industry today. It is our own answer to a problem that threatens to become even more acute."



DIRECT DATA ESTIMATOR gives machining times directly from the blueprint. Transparent plastic sheet with pre-calculated time values is placed over drawing of piece. Time for each operation then can be found directly above completion point of cut. Estimator shown is for turret-lathe operations and contains, on one sheet, times for turning, boring, facing, drilling, reaming, spot drilling, tapping, and threading. Conversion factors account for differences in machinability, feed rates, and other conditions that may vary from job to job and affect the time

"Direct data" cuts estimating time 66%

DIRECT DATA is a method of determining machine time by placing over a blueprint a transparent sheet that has pre-calculated time values printed on its surface. By positioning this sheet so the centerline and start of cut of both the transparent sheet and the blueprint coincide, the completion point of the cut on the blueprint will be directly below the pre-calculated time required to complete that cut. This time is qualified by a constant appropriate to the tool and material used. Thus, with a transparent Direct Data sheet for each type of machine, one analyst can turn out job estimates with a minimum of calculation and trouble.

My experience to date indicates that I can turn out about three times as many estimates per hour with direct data as with conventional standard data. On a job that is explained in detail later in this article, I was able to prepare an estimate by direct data in 9.72 minutes; by standard data, the same estimate required 34.7 minutes. In this case, conventional methods took 3.55 times as long as direct data.

Whether these savings can be expected generally, of course, is debatable. However, the concept underlying direct data is to eliminate all calculations, notations, etc, that are not essential. This in itself, should result in appreciable savings in the time required for estimating.

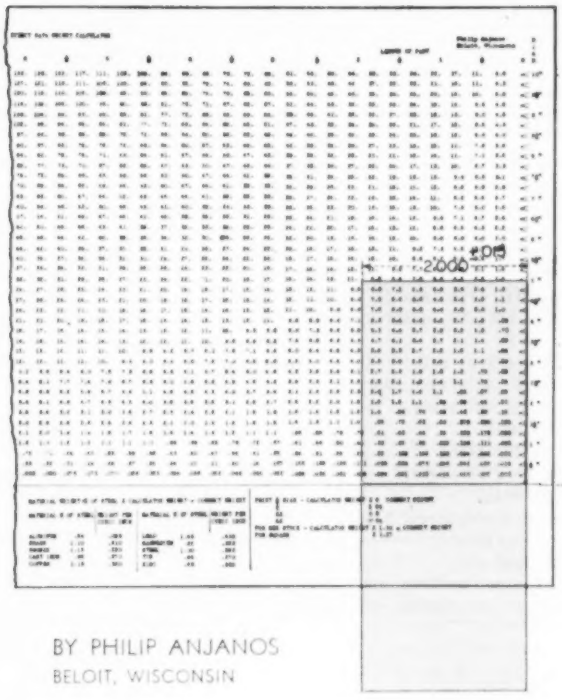
Accuracy has proved very close to standard data in our plant. Actually many of the machining times on the transparent sheet are straight mathematical calculations. Handling and setup times are taken from standard data available in the shop. These figures have proved entirely satisfactory in our plant but, of course, should be checked thoroughly by anyone who might want to apply the direct data method to his operations.

To date, direct data has been applied only to estimating and the determining of machine loads. With some modifications, I feel that it could be applied for rate setting also. However, union contract provisions and other factors must be investigated before considering this application.

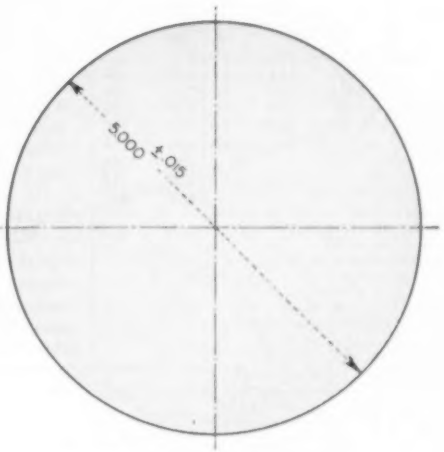
So far, I have developed direct-data estimators for bar-stock weights, turret-lathe, external and face grinding, internal and face grinding, milling, and drilling operations. In this article, only the weight calculator and the turret-lathe estimator are described. But the principle is the same for all.

HOW TO ESTIMATE JOBS

When estimating the cost of a new product or a new job, it is desirable to have a fast, accurate method of establishing time for an individual operation. At present this can be done by using past records on parts or products that are similar in many respects. However, if the part or product is new, no records



WEIGHT CALCULATOR is based on same principle as turret-lathe estimator. Centerline of estimator is placed over centerline of piece drawing with arrows touching right side of piece. Weight of piece then is shown at the intersection of the largest diameter and left side of piece. For piece shown, weight is 11 lb. Designed for steel and round bar, calculator can be used for other materials and other shapes by applying conversion factors at bottom of calculator



BY PHILIP ANJANOS
BELOIT, WISCONSIN

Recently developed and tried only in one machining department of a large midwestern company, a new trick in job estimating enables the originator to turn out accurate estimates at three times former speed. Here's the details on a method for obtaining machining times directly from the blueprint

of past costs are available. If this is the situation, there are two recourses:

The first is to use guess-timation. Unless performed by a man who has had a great deal of shop experience, this method is hardly worth mentioning. The second method is to use standard data. This fits all the requisites of a good system of estimating except that it is neither fast nor easy to use. Feeds, speeds, length of cut plus approach and overtravel, time per cut, type of cut, number of cuts, and manual elements must be recorded. After this, each cut must be calculated individually and machine and manual times must be totaled. All of this recording and referring to the standard data book for speeds, feeds, manual elements, etc., in addition to the required calculations, is time consuming at best. It was with these points in mind plus a stack of new-product prints on my desk with a deadline that this method of using direct data was developed.

To simplify standard data for quick estimating, I developed the following principles upon which direct data is based:

1. Precalculated times for different types of cuts using a fixed feed and speed.
2. Conversion factors to account for differences in machinability, feed rates, speed, and tool materials.
3. Pre-positioning of times in actual linear relationship as to diameter and length of cut on a transparent sheet.
4. Establishing of times for operations by superimposing this sheet on a blueprint and reading the time on the plastic sheet positioned at the end of the cut.

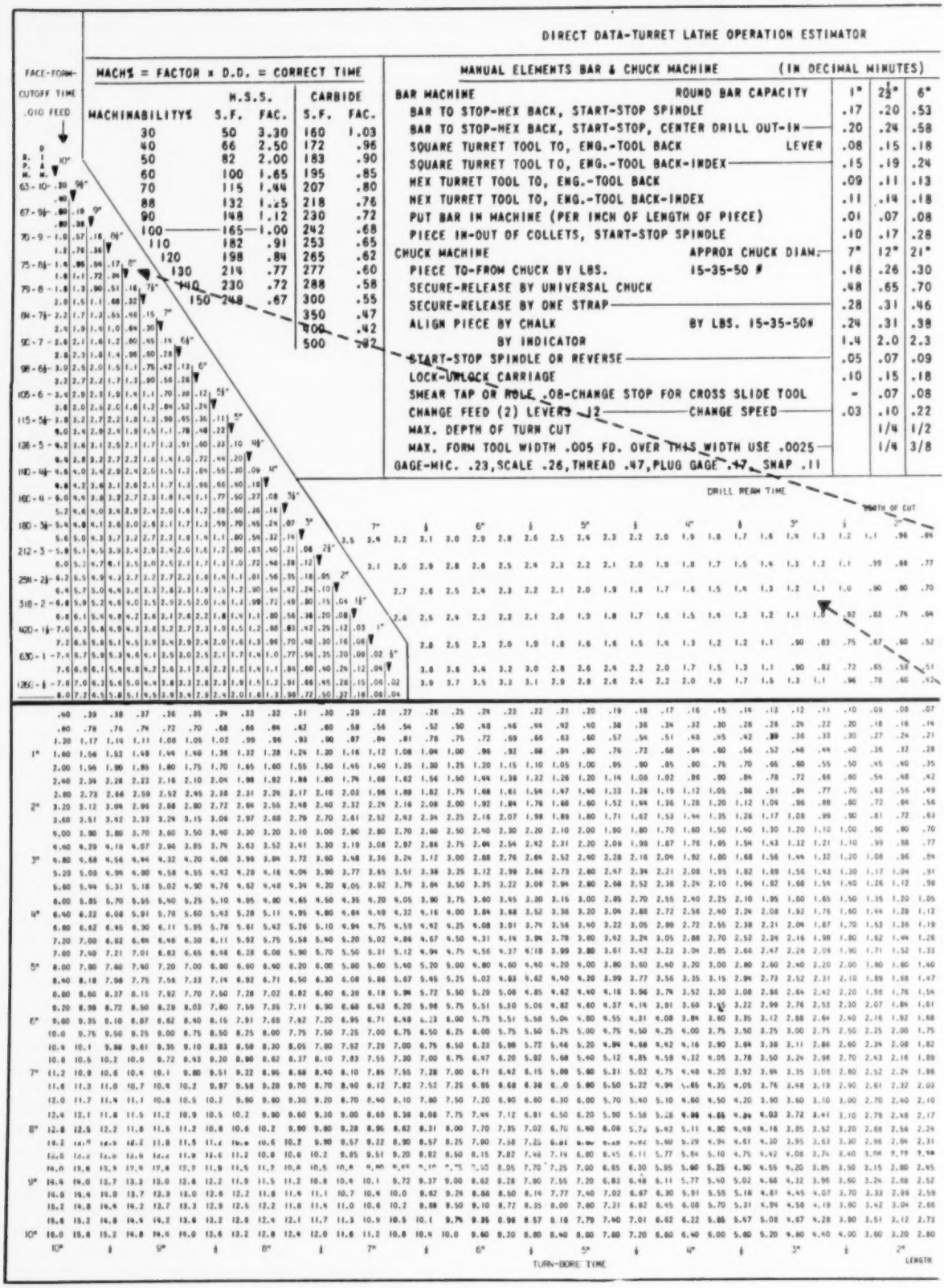
WEIGHT CALCULATOR

To illustrate the application of direct data, consider first the calculator for determining barstock weight. This is simple and easily understood, yet it retains all the principles of other direct data calculators.

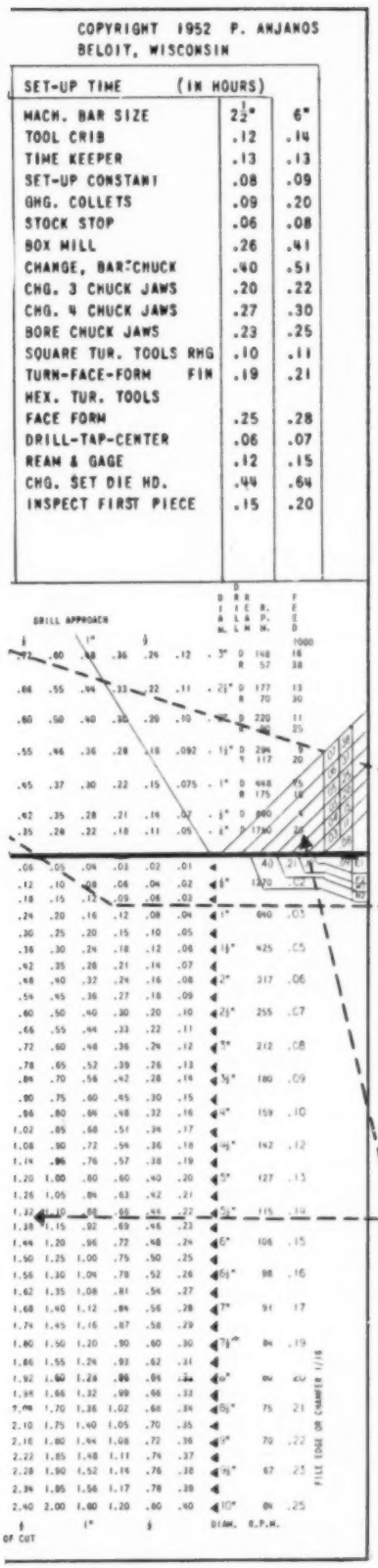
The calculator consists of a plastic sheet 11×7×0.005 in. thick. Bar diameters in ¼-in. increments extend upward from the centerline. Across the top are lengths in ¼-in. increments. These figures are in actual linear measurement. The intersection of any diameter and length of cut in the same plane is marked by a point. The figure at this point is the pre-calculated weight for that diameter bar and length of piece.

In use, the calculator is positioned with its centerline over the centerline of the blueprint and its arrows just touching right side of the piece. (Illustrated above). To allow for facing or cutoff, shift the calculator to provide stock on the right side

FOR SPEED AND CONVENIENCE, ESTIMATOR GROUPS ALL TURRET


DIRECT DATA-TURRET LATHE OPERATION ESTIMATOR
MACH% = FACTOR x D.D. = CORRECT TIME
MACHINABILITY%
H.S.S. S.F. FAC.
CARBIDE S.F. FAC.
30 50 3.30 160 1.03
40 66 2.50 172 .96
50 82 2.00 183 .90
60 100 1.65 195 .85
70 115 1.44 207 .80
88 132 1.25 218 .76
90 148 1.12 230 .72
100 165 1.00 242 .68
110 182 .91 253 .65
120 198 .84 265 .62
130 214 .77 277 .60
140 230 .72 288 .58
150 248 .67 300 .55
350 .47
400 .42
500 .32
MANUAL ELEMENTS BAR & CHUCK MACHINE (IN DECIMAL MINUTES)
BAR MACHINE ROUND BAR CAPACITY 1" 2½" 6"
BAR TO STOP-HEX BACK, START-STOP SPINDLE .17 .20 .53
BAR TO STOP-HEX BACK, START-STOP, CENTER DRILL OUT-IN .20 .24 .58
SQUARE TURRET TOOL TO, ENG.-TOOL BACK LEVER .08 .15 .18
SQUARE TURRET TOOL TO, ENG.-TOOL BACK-INDEX .15 .19 .24
HEX TURRET TOOL TO, ENG.-TOOL BACK .09 .11 .13
HEX TURRET TOOL TO, ENG.-TOOL BACK-INDEX .11 .14 .18
PUT BAR IN MACHINE (PER INCH OF LENGTH OF PIECE) .01 .07 .08
PIECE IN-OUT OF COLLETS, START-STOP SPINDLE .10 .17 .28
CHUCK MACHINE APPROX CHUCK DIAM. 7" 12" 21"
PIECE TO-FROM CHUCK BY LBS. 15-35-50 # .16 .26 .30
SECURE-RELEASE BY UNIVERSAL CHUCK .48 .65 .70
SECURE-RELEASE BY ONE STRAP .28 .31 .46
ALIGN PIECE BY CHALK BY LBS. 15-35-50# .24 .31 .38
BY INDICATOR 1.4 2.0 2.3
START-STOP SPINDLE OR REVERSE .05 .07 .09
LOCK-UNLOCK CARRIAGE .10 .15 .18
SMEAR TAP OR HOLE .08-CHANGE STOP FOR CROSS SLIDE TOOL - .07 .08
CHANGE FEED (2) LEVERS .12 CHANGE SPEED .03 .10 .22
MAX. DEPTH OF TURN CUT 1/4 1/2
MAX. FORM TOOL WIDTH .005 FD. OVER THIS WIDTH USE .0025 1/4 3/8
GAGE-MIC. .23, SCALE .26, THREAD .47, PLUG GAGE .47, SNAP .11
FACE-FORM-CUTOFF TIME .010 FEED
DRILL REAM TIME
DEPTH OF CUT
TURN-BORE TIME
LENGTH

LATHE TIMES


COPYRIGHT 1952 P. ANJANOS
BELOIT, WISCONSIN
SET-UP TIME (IN HOURS)
MACH. BAR SIZE 2½" 6"
TOOL CRIB .12 .14
TIME KEEPER .13 .13
SET-UP CONSTANT .08 .09
CHG. COLLETS .09 .20
STOCK STOP .06 .08
BOX MILL .26 .41
CHANGE, BAR-CHUCK .40 .51
CHG. 3 CHUCK JAWS .20 .22
CHG. 4 CHUCK JAWS .27 .30
BORE CHUCK JAWS .23 .25
SQUARE TUR. TOOLS RHG .10 .11
TURN-FACE-FORM FIN .19 .21
HEX. TUR. TOOLS
FACE FORM .25 .28
DRILL-TAP-CENTER .06 .07
REAM & GAGE .12 .15
CHG. SET DIE HD. .44 .64
INSPECT FIRST PIECE .15 .20
DRILL APPROACH
FILE EDGE OR CHAMFER 1/16
DIAM. R.P.M.
OF CUT

HOW TO USE THE ESTIMATOR

The estimator contains both machining and handling times for the major turret lathe operations. Setup times also are given. Both setup and handling times can be determined simply by selecting the proper value from the tables (top, center and right).* Machining values can be obtained by placing the estimator over the drawing and reading the values indicated, as will be explained below. By totaling the values for the operations required to complete any given job, an accurate estimate of the actual time to produce the piece can be obtained. (This does not include allowances, such as are required for tool resetting and so on. These are best determined in each individual plant.)

Machining values on the estimator are the actual times required to make a given cut at a predetermined fixed speed and feed. Times for turning, boring, facing, forming, and cutoff are based on 0.010 ipr and 165 sfpm, the generally accepted speed for machining AISI B1112 steel with HSS tools. At this speed and feed, the time to turn a 1-in. surface on a 2-in. dia bar, for example, figures out by simple arithmetic to be 0.32 min. Similar calculations have been made for a number of lengths and diameters. The results of these calculations have been arranged in the form of the estimator so they can be applied quickly and easily to the actual job of estimating.

For materials other than B1112, the values obtained from the estimator are multiplied by the conversion factors listed in the upper left-hand corner of the estimator. These account for difference in machinability. A second set of multipliers is listed to convert the values from HSS to carbide tooling. These need be applied only once after the values for each operation are totaled. Should the feed rate differ from that upon which the estimator is based, the value for the individual operation is changed accordingly.

Machining values have been arranged in correct linear relationship to the centerline of the estimator. Time values for turning a 1-in. long surface, for example, are in a column located 1 in. from a baseline (arrowpoints) at the right side of the TURNING and BORING section. The vertical position of the values in the column is in reference to the estimator centerline. The value for turning on a 2-in. dia, for example, is exactly 1 in. below the centerline. All other machining values on the estimator are arranged similarly.

To find the machining time for any operation, the centerline of the estimator first is placed over the centerline of the drawing of the piece. Final positioning then is accomplished by aligning the arrowpoints on the estimator with the end or the OD of the piece, depending upon the operation being performed.

Face, Form, and Cutoff — Move the estimator along its centerline until an arrowpoint on one of the vertical columns touches the point at which the cut is to begin. Run down the column to the point at which the cut ends. The value at this point is the time required for the cut. For example, facing a 3-in. dia bar requires 0.72 min. The time for a cut of any intermediate length can be determined in the same way.

Drill and Ream — Position the arrowpoints located at the right of the drill ream values so the arrowpoints touch the right side of the piece. Select the row of values for the diameter nearest that of the hole to be drilled and move left to the point at which the cut is completed. The value at this point is the time for the cut.

To allow for the drill point, slide the estimator to the right until the Drill Approach Line and the diameter of the hole to be drilled coincide. Then read drill time at the end of the drilled hole.

Values are based on a speed that is 70% of that for face, form, and cutoff. Feed rates are listed at the right of the arrowpoints. Reaming is performed at half the speed and double the feed of drilling, making the time values equal. Times are based on drilling to a depth of 3x dia, back-off, 2x dia, back-off, and a back-off for each 1x dia thereafter. Holes deeper than 5x dia are considered deep-hole drilling. Speed is reduced 40%, feed 20%. The transition point is indicated by double decimals on the estimator.

Turn and Bore — Position the estimator so the arrowpoints for the turning-boring data are touching the right side of the piece. Move left along the row of values closest to the OD to the point at which the cut ends. Read the turning or boring value directly above this point. For example, turning a 4½-in. dia, 1¾-in. long, requires 1.26 min.

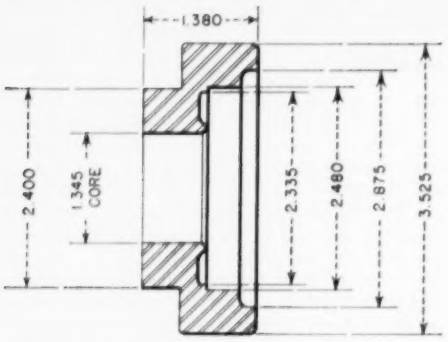
Spot and Centerdrill — To the extreme right on and above the centerline is spotdrill time; below the centerline is the centerdrill time. There are based on available data at same rpm as the drills. The longer time given is to spotdrill from a flat surface to that diameter. The smaller to spotdrill from one size to the next larger spotdrill size.

Threading and Tapping — Can not be obtained directly from the estimator. A conversion factor is applied to turning times to account for differences in speed and feed between turning and threading or tapping.

*Values for handling (manual elements) and setup times were developed by the author and have proved accurate for the conditions under which they were established. Before they are applied in any other plant, however, they should be checked thoroughly to determine their accuracy under the conditions existing in that plant.

PLEASE TURN PAGE

HOW "DIRECT DATA" IS APPLIED...



INPUT GEAR is SAE 4615, is machined on a 6-in.-capacity turret lathe. Time estimate for this job is shown at right

OPERATION ESTIMATE for input gear contain all the facts for the estimate on one sheet. Times for operations 2, 5, 6, and 7 have been adjusted to account for a feed of 0.005 ipr rather than the 0.010 ipr upon which the estimator is based. Times for cuts 8, 10, and 11 have adjusted to a 0.002-ipr feed. The sum of the machining values then is multiplied by 1.51 to adjust times for SAE 4615 steel which has a machinability of 66%. Manual times are listed below and are added to the adjusted machine time to give a total time of 18.01 minutes

OPERATION ESTIMATE

PART NAME Input Gear — PART NO. 605733
MATERIAL SAE 4615 — MACHINABILITY 66% — OPER. NO. 20
DATE 8/29/52 — STANDARD — MACH. 3-A W&S Bar

NO	ELEMENTAL DESCRIPTION		D.D. TIME FROM CALCULATOR	FEED	TIME
1	Face	3-3/4" Diameter	1.20	.010	1.20
2	Turn O.D.	3.525" Diameter	1.05	.005=X2	2.10
3	Spotdrill	1-1/4" Diameter	.25	Hand	.25
4	Drill Thru	1-1/4" Diameter	.55	.009	.55
5	C'bore Small	2.480" Diameter	.30	.005=X2	.60
6	C'bore Large	2.875" Diameter	.12	.005=X2	.24
7	Bore	1.345" Diameter	.24	.005=X2	:48
8	Relieve	2.335" Diameter	.05	.002=X5	.25
9	Chamfer	1.345" Diameter	.05	Hand	.05
10	Form Small O.D.	2.400" Diameter	.35	.002=X5	1.75
11	Cutoff		.40	.002=X5	2.00
			100%/66% = 1.515 X 9.47	=	9.47
					14.30
	Bar to stop		.18 X 4		.53
	Hex turret		.24 X 7		.72
	Square turret		.12 X 7		1.68
	Change feed		.08 X 2		.84
	Put bar in machine				.16
			TOTAL TIME		18.23

between the piece and the arrows, then move to the left of the piece, a distance equal to the width of the cutoff.

The weight calculator is based on round steel bar. For other materials, calculator weights are multiplied by the factors listed at the bottom of the plastic sheet. These express in percentage the relationship of the weight of the other material to that of steel. The weight of aluminum, for example, is 34% of the weight of steel. The weight per cubic inch of material also is listed. This was done so, if the volume of the bar is desired, it can be obtained by dividing the weight of the bar by the weight per cubic inch of the material.

Factors also are given for converting the weight values to hex, square, or octagonal bars, and to account for ½-, ¼-, and other-scale drawings.

Compared to the usual method of looking up the weight per foot of a certain bar size in a table, determining the weight per inch by division and then multiplying this weight per inch times the length of stock, the weight calculator greatly simplifies the procedure. In some cases, interpolation may be necessary. Straight linear interpolation can be used on the length of the piece. On the diameter logarithmic interpolation is necessary. However, this is not recommended. A table that I now am making up includes ⅛-in. increments.

TURRET LATHE ESTIMATOR

The turret lathe estimator, illustrated and explained in detail on the preceding pages, is based on the same principle as the weight calculator just described. By placing the estimator on the drawing, it is possible to obtain directly actual machining times for turning, boring, drilling, reaming, facing, forming, cutoff, and spot drilling. Threading and tapping times can be found indirectly by applying one calculation to turning time.

Times for the manual work required in operating a turret lathe are given in decimal minutes. These cover sizes up to 6-in. dia round bar; also chucking work. Setup times are in decimal hours. All manual and setup values were taken from standard data available in our plant.

Conversion factors are given to account for differences in the machinability of various materials. The times on the estimator, for example, are based on machining AISI B1112 steel at 165 sfpm. This steel is regarded as having 100% machinability and when estimated jobs made from this material and run at 0.010 ipm with HSS tools, the times from the estimator can be used as they are. However, a material for which the optimum speed is 148 sfpm has a machinability rating of only 90%. Therefore, times on the estimator are multiplied by 1.12 to adjust for this difference in machinability and surface feet. Factors also are given for converting from HSS to carbide. An example showing exactly how these computations are made is illustrated above.

Approach time is accounted for by positioning the locating arrows of the estimator the required distance to the right of the start of cut. On the other end of the cut, allowance for overtravel is made in a similar way.

HOW TO USE DIRECT DATA

To obtain maximum effectiveness in applying the direct-data method, rules shoulld be set up for the type of work being performed in any shop or department. These should cover the following points:

1. Maximum depth of cut practical on each machine and the tolerance obtainable by this cut.
2. Feed and depth of cut to obtain certain tol-

FEWER CALCULATIONS ARE REQUIRED WITH DIRECT DATA

Type of Calculation Per Cut	Direct Data	Standard Data
Length of Cut	(0)	(2 to 3) additions: Approach, length of cut, overtravel for turning; or subtract (2) dia. add approach and overtravel for facing.
Speed	(0)	(2) Multiplications: To determine RPM from book surface speed.
Feed	(0 to 1)	(1) Multiplication: RPM x feet
Time	(0)	(1) Division: Length of Cut / Inch per Minute
Totaling	(0 to 1)	(0 to 1) Addition:
Correcting Direct Data	1 to 1/11 Mult.	Adding up cuts (0)
Total Calculations	1/11 Min. to 3 Max.	6 Min. to 8 Max.
Average Calculations	2	7

HOW DIRECT DATA TIMES COMPARE WITH STANDARD DATA

Cut. No.	Type of Cut	Standard Data Time	D. D. Time Before Correcting	D. D. Corrected Time
1	Face	1.77	1.20	1.82
2	Turn O. D.	3.10	2.10	3.18
3	Spotdrill	.38	.25	.38
4	Drill	.85	.55	.83
5	C'bore Small	.79	.60	.90
6	C'bore Large	.37	.24	.36
7	Bore	.62	.48	.72
8	Relieve	.32	.25	.37
9	Chamfer	.08	.05	.07
10	Form Small Dia.	2.63	1.75	2.65
11	Cutoff	3.04	2.00	3.02
Total Time		13.95	9.47	14.30

erances and micro finishes for certain machinability materials.

3. Speed increase or decrease for type of tool, depth of cut, and width of tool.
4. Amount of gaging required for a given tolerance.

Rules established for each of these machining conditions are considered primarily as guides. They must be in accord with current shop practice yet must be flexible enough to permit changes when the job warrants. Data of this kind which actually amount to a recommended practice guide for the shop, are particularly helpful for consistent estimating.

COMPARISON WITH STANDARD DATA

In the comparison below it can be seen that the corresponding times are very close.

	Machine Time	Manual Time	Total Time	Time Required to Compute
Direct Data	14.30	3.93	18.23	9.7
Standard Data	13.95	4.04	17.99	34.7

Actually the times should compare. Direct data are a form of standard data except that standard data machine times are based on available specific feeds and speeds on one machine while direct data are based on the optimum speed and selected feed. In the comparison, optimum speeds were used for a more favorable comparison. If available speeds were used it would involve more time on the part of standard data to look up and select from those available. In the long run speeds selected above or below optimum tend to average out.

The turret-lathe estimator can be used on prints one-half size or two times size by multiplying the time by four or dividing by four as the case may be.

◀HERE ARE DETAILS ON THE ESTIMATE SHOWN

Time for the input gear shown was estimated with the Direct Data Estimator. Operations in the sequence in which they will be performed are listed on the Operation Estimate. All factors affecting time are noted. For simplicity, it is assumed that on this job all tools are HSS and only one cut is performed at any one time.

Times are selected by placing the estimator on the blueprint. If the feed rate differs from the 0.010 ipr for which the table was developed, the time is adjusted mentally to account for the difference. The time for operation number 2, for example, is 1.05 min on the estimator. Because of the 0.005-ipr feed, however, the time listed on the Operation Estimate is 2.10 min.

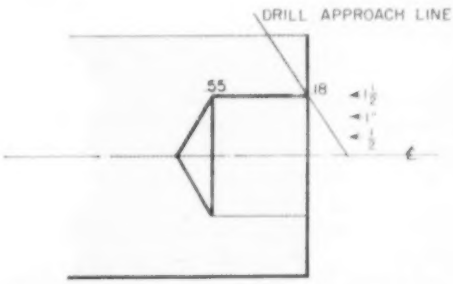
Times selected from the estimator total 9.33 min. If the material were B 1112, which has a machinability of 100%, 9.33 would be correct for the machining shown. However, SAE 4615 has a machinability rating of 66%. Time, being inversely proportional to machinability, is multiplied by 66 ÷ 100 = 1.51, giving an adjusted time of 14.08 minutes.

When both HSS and carbide are used, the times are totaled separately and are qualified by their respective factors. The two times then are totaled. In all cases, the Operation Estimate is held as a permanent record for comparison against the actual time required when the job is run.

Estimating the above job with standard data took me 34.7 minutes and involved recording data on 9 separate estimating forms. By Direct Data the identical job required 9.72 minutes. This is a ratio of 3.55 to 1.

The accompanying table compares results obtained by both methods of estimating. If Direct Data had been interpolated, the final answer would have been close. However, only the time for cut 8, which is a small cut, was interpolated.

Also shown is a comparison of the number of calculations required by Direct Data and standard data. This reveals a 3½ to 1 ratio, which is almost equal to the ratio of time (3.55 to 1) required for estimating this one job. It should be pointed out, of course, that a considerable number of trial estimates under varying conditions, in various shops, and by different people would have to be performed before a reliable claim to a time saving could be made. The most that can be said at present is that within my experience savings of 3 to 1 have been realized and I believe that the application of the Direct Data technique in other plants would produce appreciable savings in the time required to prepare job estimates.

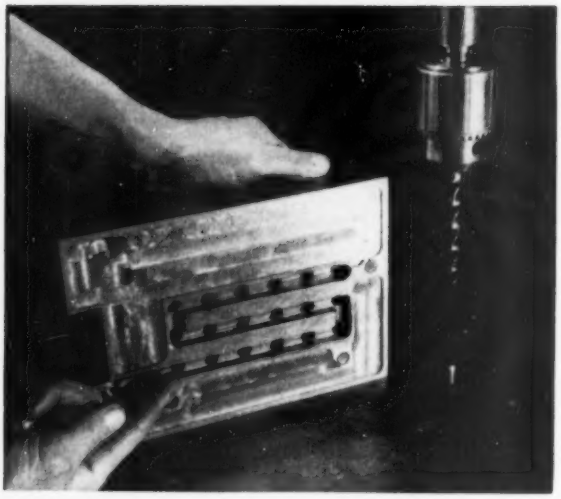


TO ALLOW FOR DRILL POINT ANGLE, slide estimator to right until Drill Approach Line and diameter of drilled hole coincide. Then read time at end of hole

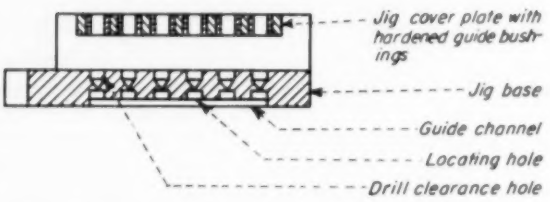
This method works in the cross and longitudinal cuts but not in the drill-ream section.

The only disadvantages of direct data that I can see at this time are: first, its size limitation. The calculator is approximately 12x12 in. and this limits the size of job on which it can be used. Second, the print sometimes must be turned 180° to enable the drill section to superimpose a blind drilled hole from the proper end.

PEDAL VALVE on floor controls position of locating pin in drillpress table for quick centering of location hole over pin to align carbide drill with guide bushing in jig for Micarta parts



THICKENED BASE of leaf-type jig is drilled with location hole under each drill guide bushing, and has guide channel approx 0.005 in. larger than pin in machine table to prevent binding



METAL WEB between clearance hole in base of jig and inverted locating hole immediately below prevents carbide-tipped drill striking hardened locating pin when drill breaks through workpiece

self-positioning jig cuts drill breakage

BY ROBERT DOUBLE, Manufacturing Engineer, Manufacturing Engineering Laboratory, WESTINGHOUSE ELECTRIC CORP

CARBIDE-TIPPED drills stand up well when drilling highly abrasive Micarta laminated-phenolic parts. But when used with jigs having hardened-steel guide bushings, drill-point breakage is high unless the bushing is aligned accurately with the drill for each hole. Side pressure on the rotating carbide tip is almost sure to result in chipped or broken cutting edges.

Production studies of this problem by Westinghouse manufacturing engineers has resulted in the development of a jig design which simplifies jig location for each succeeding hole—and in most cases reduces materially the time required by the operator to position the jig for each hole.

Basically, the jig is like most conventional leaf-type drill jigs for flat parts. It is novel only in the use of a thicker base with a locating hole directly beneath each guide bushing and in the use of guide channels to simplify movement of the jig to locate succeeding holes.

To permit the drill to clear through the workpiece, a bottomed hole is provided under each hole location. Under each of these clearance holes is an inverted location hole which centers the jig over a retractable pin set into the drillpress table and controlled by a double-acting air cylinder.

For a given jig, pin diameter can be any convenient size, provided it is less than the distance between the closest adjacent locating holes. The hardened pin projects above the table approx two diameters when in the top position for entry into a jig location hole, and is retracted a little more than one diameter when the jig is to be moved between holes. This leaves the pin projecting a little less than one diameter above the table, so it engages in the guide channel end-milled into the base of the jig for guiding between holes.

The pin is guided in a hardened steel bushing set into the drillpress table, and pin-and-bushing sets can be removed easily to change pin size for different jigs. The OD of the pin guide bushing is held constant so pin-and-bushing pairs are interchangeable in the machine table.

ROUND TABLE

Lambs or Goats?

"What's this I hear about you goin' to buy Saturday-night supper for your gang of hoodlums, Al? Anything to the wild rumor?"

"Sure is, Ed. It's just a little scheme to promote more harmony in the department."

"Boy, that'll kill your next paycheck!"

"Not at all, Ed. The big boss is coming—and he's footing the bill. He thinks the idea is fine and believes it will be worth the price."

"Yeah? Then what's the real reason for the blowout—aside from stuffing your boys full of steak and lobster?"

"Just like I said, Ed; it's a social get-together to improve personnel relationships. It ought to relax everyone a little and make working together easier. In fact, I'm going to arrange for old Tom O'Hara and Ed Harris to sit together."

"Oh, I see. That's the entertainment—when they start fighting like cats and dogs, as they always do."

"I don't think so, Ed. It's hard for a couple of men who don't get along to eat together and keep fighting. I hope to break up that little feud."

"I think you are wasting your effort, Al."

"Well, maybe. But there's also the factor of creating confidence between the men and the old man. They don't get to sit in on executive dinners, and they might like the chance to be treated on a level with the boss."

"I'll bet the boys will smell a rat and start thinking you're trying to put something over on them; especially if you or the boss gives a speech."

"No speeches, Ed. Just food and any kind of talk that happens to come up."

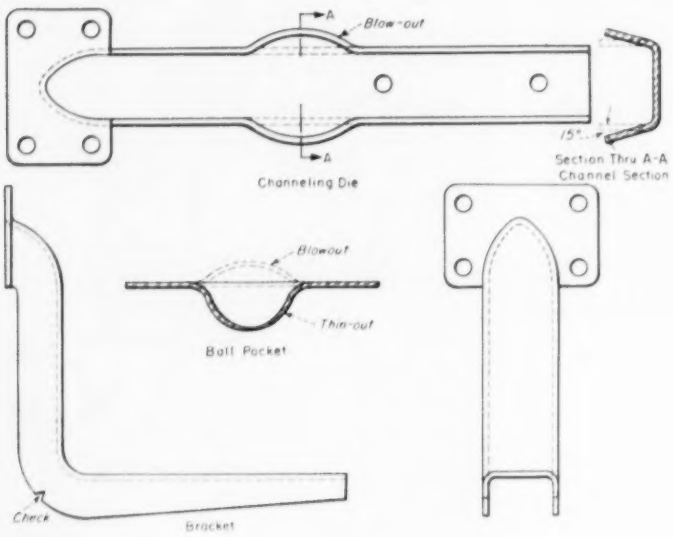
"You'd better plan on keeping up the conversation then. I know some of the men will balk at having to be sociable with the boss. It's not that they don't like him; they just don't trust him completely."

"Well that's just what we're trying to reach—that instinctive distrust. It might take a long time and many dinners, but the plan is to get at that feeling of wariness, Ed."

"Might work, but you're going to hear a bunch of gripes on Monday about how the boss can better afford a lot of raises instead of a silly dinner."

***HOW** far can company entertainment of the working force go without becoming too paternalistic? Will the men resent management's wish to become more friendly? Can this sort of idea work with a different approach? Your comments on this question may help others solve similar problems. Discussions of earlier topics appear on later pages.*

Practical Ideas



Blow-Out Simplifies Elongation in forming

In a right-angle bending operation to produce a simple running-board bracket for a special truck chassis, we ran into a genuine bottleneck. The metal at the outside edge of the bend would thin-out and tear every time we formed a bracket. We tried filing and spot-annealing the sheared edge, but neither did any good. The simple solution was adding a blow-out in the channeling die at the point where the stretching occured during bending. Now, during bending, the channel flanges merely straighten out and tearing is eliminated.

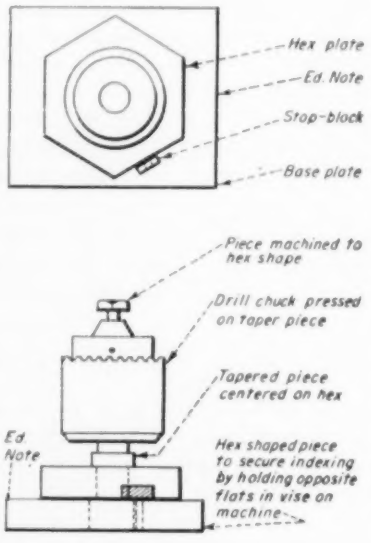
A similar condition developed in forming a ball-shaped pocket in the flange of a chassis-frame cross-member. This time we made a blow-out in the opposite direction from the pocket location and then merely pushed the metal back into the desired ball-shape. Both parts were hot-rolled 0.15 to 0.18 carbon steel, 0.125 in. thick.

The amount of blow-out required is determined by the extent of the elongation created during forming or bending. Actually, a little more metal is being provided to allow for the stretch. The channel section shows the approximate angle for the blow-out in this operation. Clearance must be provided in the bending-die punch for the 15° flare of the blow-out. *George Oliver, Warren, NY*

Simple Setup Mills Hexagonals

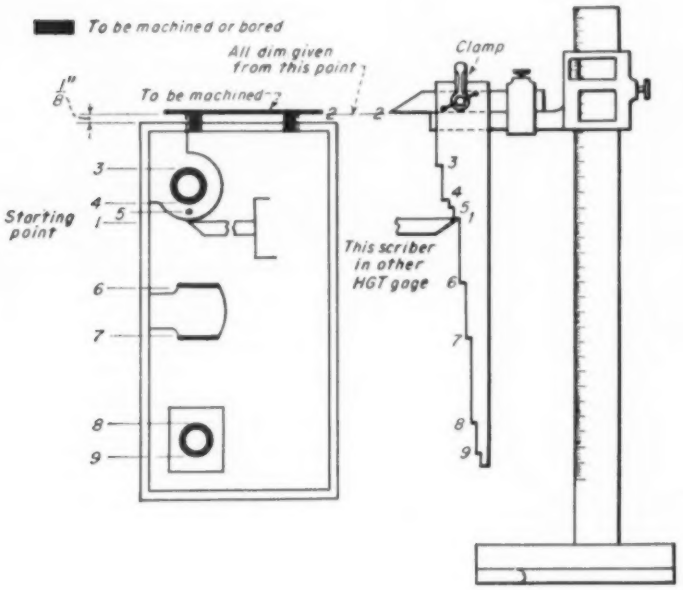
From time to time it is necessary to mill a hexagon on a small diameter and considerable time is required to set up an indexing fixture for the job. As most of our other milling jobs are done in a vise, we made a small fixture which can be vise-mounted and which will produce a very satisfactory hex.

A drill chuck is mounted in the center of a hexagonal plate as shown. By gripping the opposite flats of the hexagon, the corresponding flats of the piece are readily milled. In three clampings the piece is completed. This fixture proved so useful for milling and drilling that an additional setup was made with a drill chuck fastened in the center of a square plate. The latter proved especially good for holding screws and studs during slotting and cross-drilling operations. *William R Wade, Beverly, Mass.*


Hex plate
Ed. Note
Stop-block
Base plate
Piece machined to hex shape
Drill chuck pressed on taper piece
Tapered piece centered on hex
Ed Note
Hex shaped piece to secure indexing by holding opposite flats in vise on machine

Ed Note:

This fixture can be improved by adding a round boss to the bottoms of the hexagonal and square plates. Then another, larger, plate is bored at the center to provide a sliding fit for the boss and the hex or square plate is assembled to ride on the larger plate. By drilling a $\frac{3}{8}$-in. dia hole in the larger plate at one flat of the smaller plate, a stop-block can be used for indexing, to eliminate reclamping for each pair of flats.



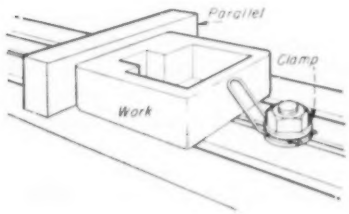
Templet Speeds Casting Layout

To equalize rapidly and lay out a casting for machining, use a templet with the key dimensions of the casting cut out as steps. This templet is clamped to a height-gage and the scriber on another height gage is butted against each step and the measurement transferred to the casting. By mounting the templet on a height-gage it can be accurately raised and lowered to favor the casting in either direction.

To layout the casting, blue it at the critical places, select a starting point, and place the inverted scriber at this point (perhaps the boss-edge of a cored hole) and mark. Next, align the templet with the scriber for this point, reset the scriber to each of the other points on the templet and, as each height is determined, transfer it to the blued surface.

The templet can also be used for inspection by placing a dial indicator on the second gage and checking the casting against the templet. Variations are shown by needle deflection from zero.

This method is not intended for inspection, but only to balance a casting for machining. Average castings are completely scribed in about 3 min. Templets can be stored to assure duplication on re-repeat orders. *Burl Mansberger, New York, NY*



Setup Clamp Holds Work Firmly for Adjustment

Recently I devised a pressure clamp that has proved useful in precision work on the vertical milling machine which I operate. Its purpose is to hold a casting tightly against a parallel while it is being fastened to the table from the top by a gooseneck clamp.

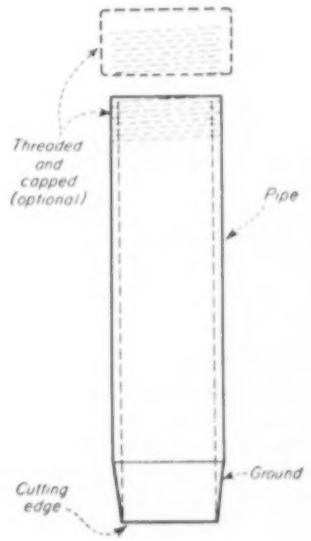
I bent a piece of drill rod, 8 in. by 5/32 in., into a U shape so it would fit snugly around a 5/8-in. T-slot bolt; then I bent the top of the U into a 45° angle.

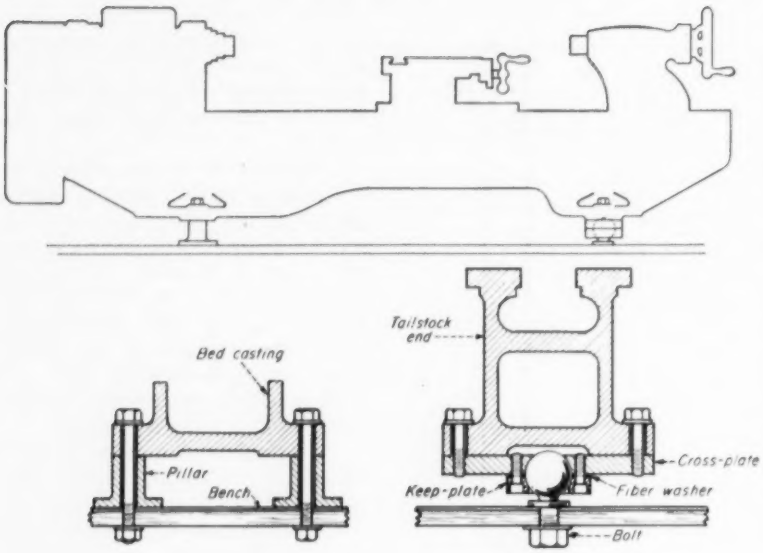
I place the bolt in the T-slot; a washer on the bolt; the U-shape drill rod; and, finally, another washer and a nut over that. Then I move the whole assembly close to the side of the casting.

When the nut is tightened on the bolt the drill rod between the washer is drawn down creating a pressure which forces the work snugly against the parallel. It is then simple to tighten the piece down from the top and proceed with the milling. *Louis Israel, Providence, RI*

Emergency Hollow Punch

When a hollow punch is needed for cutting gasket material and the proper size is not at hand, a short piece of iron or steel pipe can be substituted. One end is sharpened to a cutting edge, as shown, by grinding the outside, and filing the inside if necessary, to produce the proper diameter cutting edge.—*Thomas Trail, Catonsville, Md.*





Three-Point Lathe Mounting

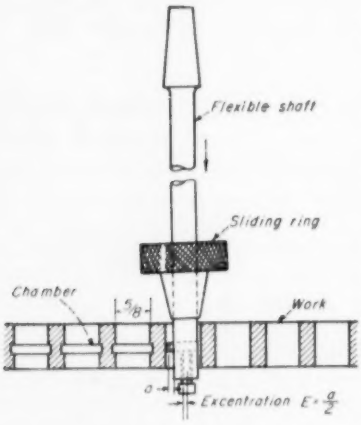
Apparently affected by changing atmospheric conditions, our small bench lathes, mounted on heavy wooden stands, were constantly twisting and warping, often pulling the lathe bed casting with them by means of the connecting bolts.

Precision levelling and packing solved the problem only temporarily. Replacements with metal stands might have given the desired stabilization but would have been very expensive. As an alternative we adopted a three-point mounting system between the bed-casting and bench top.

The headstock end of each lathe was placed upon a pair of short pillars and bolted firmly to the bench top. This gave two points of contact. Each tailstock end was then fitted with a steel cross-plate in the center of which was bored a part-spherical seating to engage with a 1¼-in.-dia steel ball. A circular keep-plate held in place by socket-head screws, holds this cross-plate in close contact with the steel ball. Fiber packing inserted between the keep-plate and cross-plate permits the engagement with the ball to be set so that it is free from slack.

Integral with the ball, the third point of contact, is a downward extending bolt. This passes through the bench top to lock it firmly in place on the underside with a nut. The lathe is rotatable.

Our lathes have remained in perfect alignment since we adopted this three-point mounting method. *Clifford T. Bower, London, England*



Sliding Guide For Chambering Tool

A sliding conical ring, acting as a drill guide, has proven to be highly efficient on a chambering tool making small holes in the multitubular plates used in heat exchangers and could easily be adapted for all similar operations.

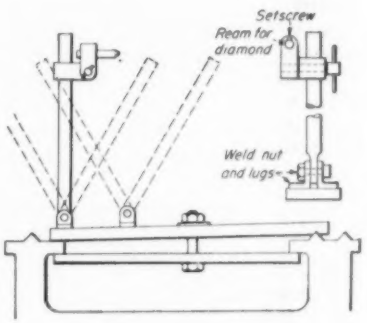
The tool, slightly bent, is held in a radial drill and lowered into a hole up to a desired stop.

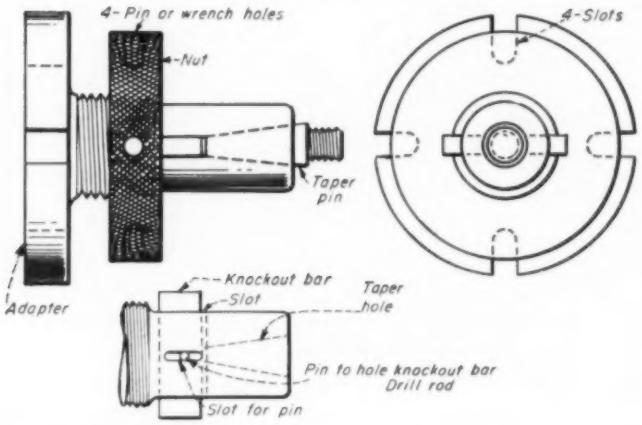
The ring, free on the shank (which should be long enough to permit a slight flexibility), is held by the fingers and lowered into the hole. The conical end guides the shank back to vertical and makes the tool cut into the stock.

The correct cutting depth attained, the drill is stopped; the ring raised; and the tool shank is bent enough to permit raising it from the hole. *L. Remacle, Spa, Belgium*

Diamond Dresser For Lathe Grinding

In shops where cylindrical grinding is done with an attachment on the lathe the method of holding a diamond dresser is frequently makeshift and sloppy. The dresser shown consists of two bars which are clamped between the lathe ways with a single bolt and a diamond support bar hinged to the upper clamp bar. This holder is rigid, yet is readily attached or removed from the lathe. *Clyde E Parker, Oakland, Calif*





Lathe Adapter Threads Taper Pin

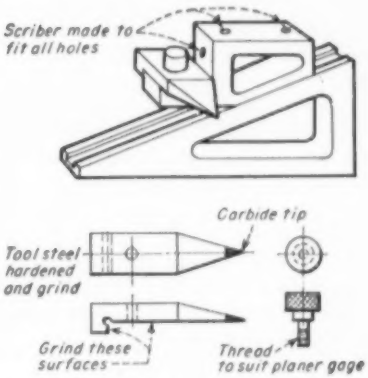
The big trouble in cutting a thread on a taper pin is in holding the pin securely for turning. If this problem is solved, it is frequently difficult to release the pin after threading. Threaded taper pins are usually used on machines when it is difficult to knock the pin free. The thread makes it possible to use a puller.

An engine lathe adapter for holding these pins during threading is made with an external thread, a suitable taper hole, and a slot for the knockout bar. A nut is threaded onto the adapter, which is turned against the inserted knockout bar to eject the taper pin after threading. A pin spanner is used to turn this nut.

For use, the taper pin is simply tapped into the taper seat with a mallet, the pin is threaded, and then the threaded pin is removed by turning the nut. *M Moran, Newark, NJ*

Planer Gage Serves as Height Gage

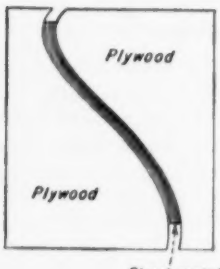
While few machinists own a vernier height gage, most of them have access to a planer gage. This will work very well as a height gage. The scriber attachment shown can be used to scribe lines accurately within the planer gage range. Gage blocks can be placed beneath the planer gage for additional height. To prevent the scriber from turning, it is shouldered to fit on the sliding block. A screw, threaded to fit the tapped holes in the sliding block, is used to clamp the scriber in place. A small piece of carbide can be brazed to the scriber tip to provide longer service and cleaner lines. *Leonard Mamola, Detroit, Mich*

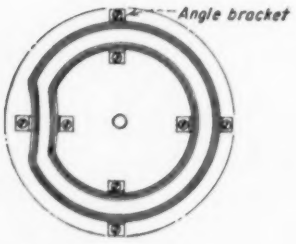


Ingenuity Speeds Equipment Installation

We recently moved our shop to larger quarters and it disgusted me to watch the way electricians and millwrights were installing materials and equipment such as lumber, plasterboard, switches, and brackets to the walls, which were cement and brick. They would lay out a hole from the part, take the part away, drill a hole with a stardrill, hammer in an anchor, and then swear because the part wouldn't match the hole. Then they proceed to drill the hole larger or start all over, with little more success. Finally, having gotten tired of watching the hours pile up and the wall fill with holes, I asked them to try it my way.

I used a ¼-in. dia carbide masonry drill in a portable electric drill to go right through the hole in the box or part and right into the wall to the correct depth. Then I took a ¼-in. dia Rawlplug (a piece of ¼-in. dia dowel would do), soaped it, and tapped it into the hole. After that it is simple to fasten the part with a screw. Soap is important, otherwise the screw will rip the plug out of the wall. With this system there was no trouble in lining up holes and less than half the original time is required to complete a hole. Actually, the drill can be used to go right through sheetmetal cabinets, and similar parts, and into the wall. When we had wood beams and partitions to put up, we did the same thing, going through the wood and into the wall with a single carbide drill. Care should be taken when drilling into wood to keep drill clear of shavings and chips. This system will work equally well, no matter what the material of the wall, whether it be brick, cement, or plaster. *J H Sperman, Brooklyn, N Y*



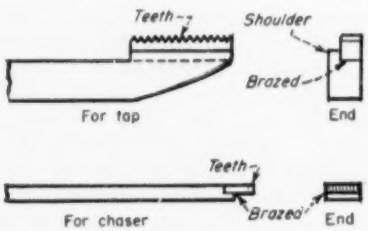


Improvised Cam Track

In experimental machine building there are many occasions when a cam, track, control, or guiding surface is needed. To economically fill this requirement, a curve is laid out and cut from plywood or die-stock of suitable thickness. Strips of sheetmetal are sheared to the desired width and are placed between the plywood sections as shown. A sufficient number of strips are used to provide the necessary strength. After clamping the strips between the plywood, they are joined by soldering along the upper and lower edges, to form a solid, fixed support.

To facilitate soldering, the alternate strips in a stack are sheared ⅛-in. narrower, thus producing grooves which can be filled with solder. If galvanized sheet is used, the solder will readily flow between the sheets to produce a very rigid structure. Steel strip should be thoroughly cleaned before clamping in position. Stock thickness is determined by the curvature to be bent. For intricate shapes, or sharp bends, the strips can be drilled and screwed to the plywood templet. Use chromium plated or stainless steel wood screws to prevent the solder from binding them in place.

Curved supports, braces, and structural members can also be formed thus, before making patterns or dies. *Henry J Gifford, New York, NY*



Broken Tap or Chaser Makes Good Thread Comb

A very satisfactory comb tool for threading can be made by brazing one land cut from a broken tap, or a single chaser, to a flat steel bar as shown. Performance is best when the tap or chaser is HSS. The bar is milled to provide a shoulder which will support the tap and is rounded at the nose to provide, clearance for internal threading. Although threads can be started and cut freehand, the tool is far more successful when the corresponding leadscrew feed is used on a lathe. This tool is particularly useful for cleaning up worn or damaged threads. Take care, when brazing, not to anneal the steel. *Milton A Frank, Frederick, Md*

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REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author —every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

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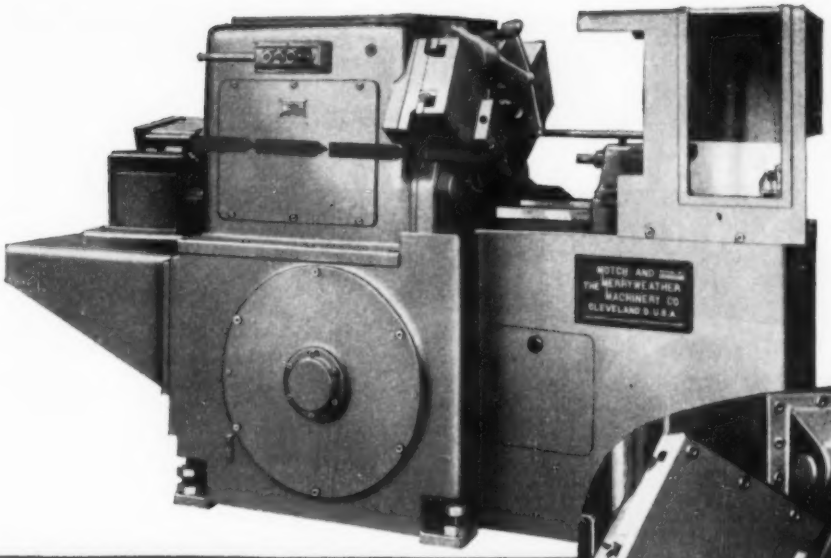

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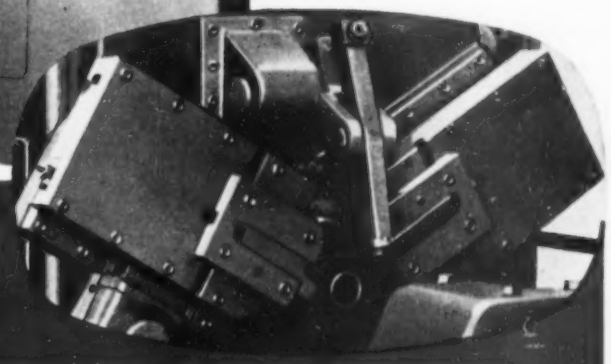
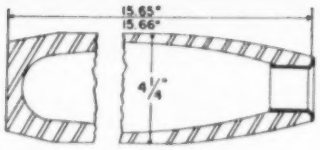
Most Production per Square Foot

Conveyor carries shells to hopper. Shells are fed automatically through hollow spindle, machined and ejected onto conveyor.

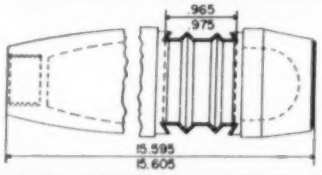


MOTCH & MERRYWEATHER *Automatics* make the most of AUTOMATION

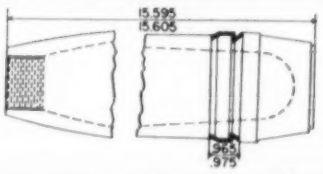
Material: shell steel SAE 1050.
Operation: bore, face, chamfer (nose end)
Estimated Production: 220 pcs/hr. @ 100%.



Material: shell steel SAE 1050.
Operation: face base, turn band groove and band relief.
Estimated Production: 120 pcs/hr. @ 100%.



Material: shell rotating band.
Operation: turn band.
Estimated Production: 220 pcs/hr. @ 100%.



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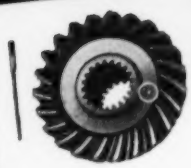
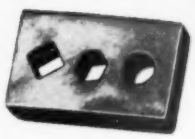
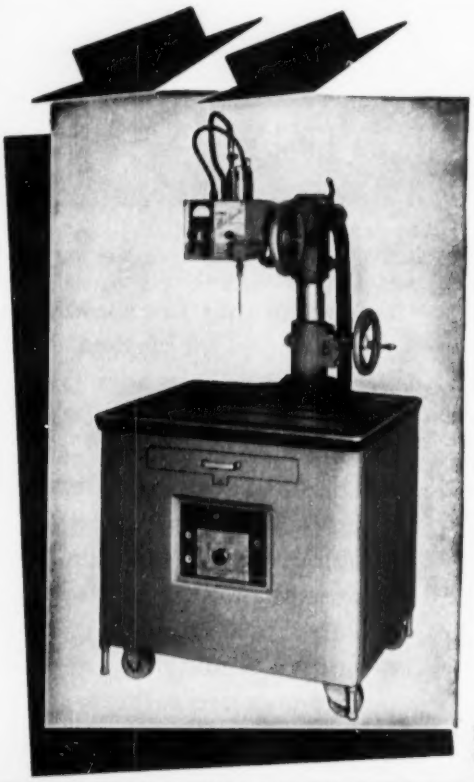


Cut oil holes in hardened gears without annealing

Cut dovetails in hardened dies



Cut any shape hole in cemented carbides



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REFERENCE BOOK SHEET

Estimating Drilling Time for Deep Holes

BY TYLER HICKS

TIME NEEDED for a drill to pass through a piece of metal of any thickness depends on drill-cone height, drill feed, drill speed and work thickness. This chart correlates these four factors and allows you quickly to estimate the time needed to drill metal parts from 1 to 18 in. thick.

EXAMPLE: How long will it take to drill a piece of steel 6 in. thick when drill-cone height is 0.5 in., feed 0.002 ipr, and drill speed 100 rpm?

SOLUTION: Enter bottom of chart at a cone height of 0.5 in. and project vertically until the 0.002-ipr-feed curve is intersected. From here project horizontally to the right to intersect the 100-rpm curve, then vertically upward to intersect the 6-in.-thickness curve. At the left read the time as 6¼ min.

This chart is specially useful when estimating job drilling time for heavy pieces like castings, armor plate and machine frames. When penetration of drill requires considerable time, you must add this amount to value found on the chart.

This chart is based on the relation

$$T = L + h\,Nf$$

where

T = drilling time, min.
L = work thickness, in.
h = drill-cone height, in.
N = drill speed, rpm
F = drill feed, ipr

The relation correlates drill and work dimensions and is based on the geometry of the two.

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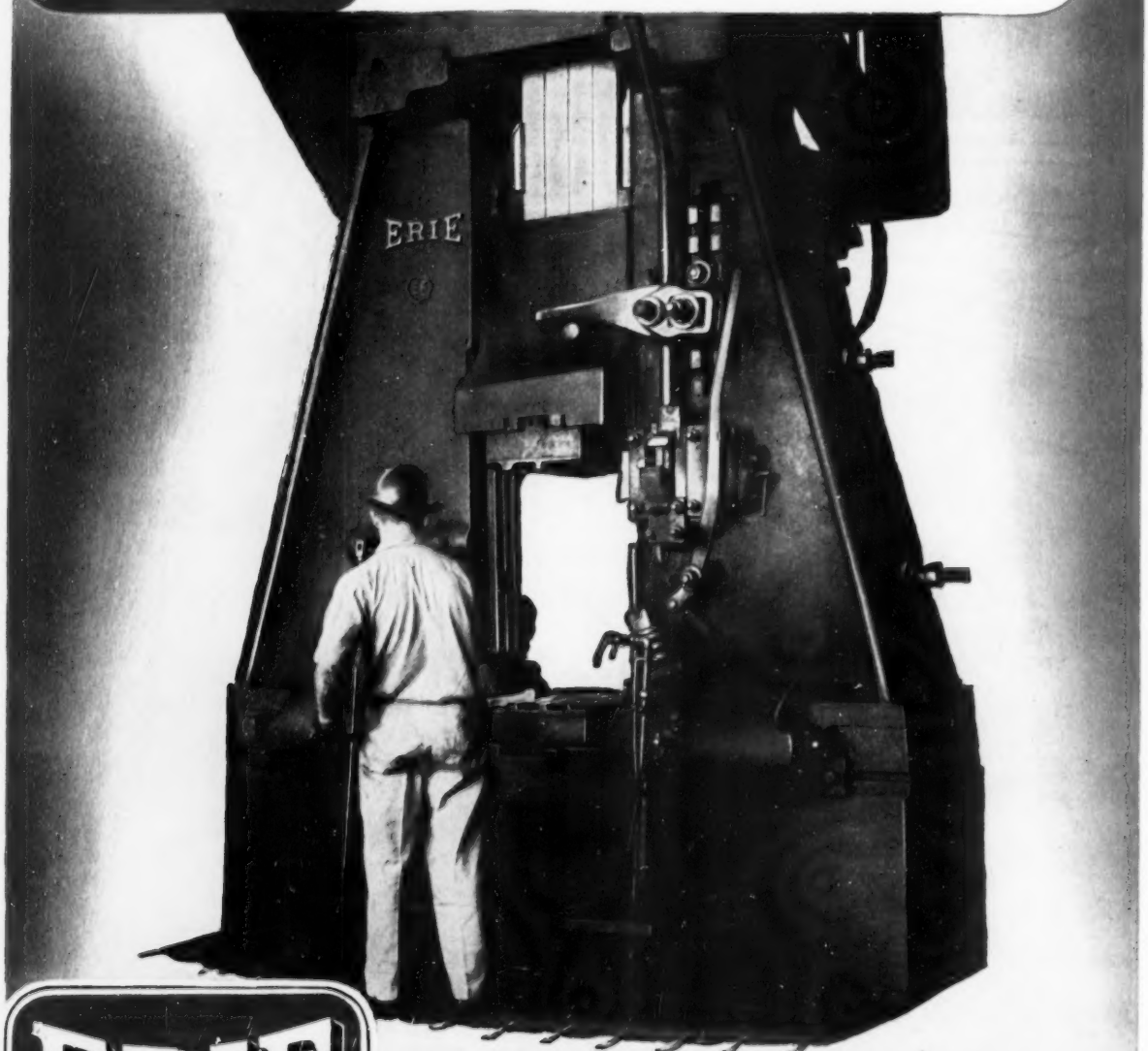

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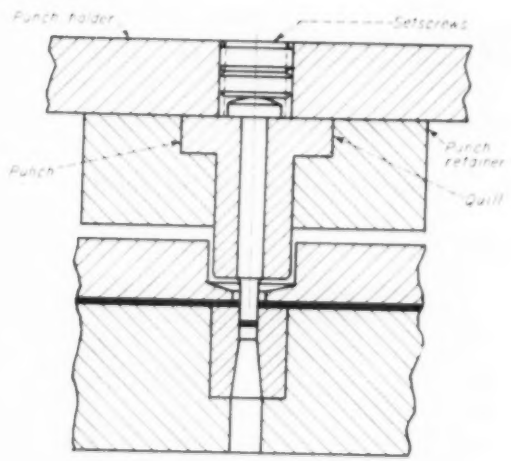
Mounting of Piercing Punches ... I

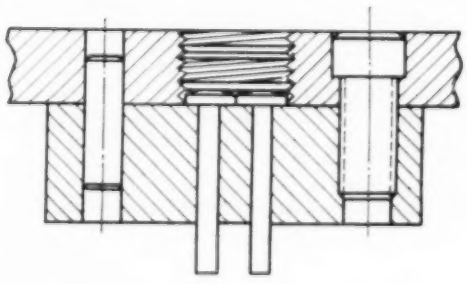
BY PETER BALSELLS

In progressive dies, small piercing punches must be held firmly and securely to avoid early breakage. Whenever possible, quills should be used on punches up to ½-in. piercing diameter. If punches are close together, a thick punch retainer should be used, in order to provide more support for the punches.

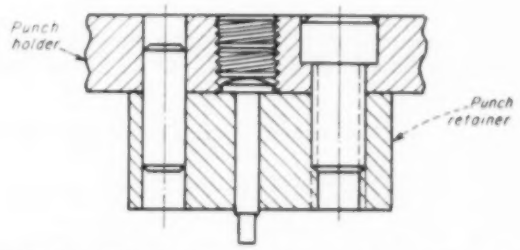
When piercing holes over ½-in. dia, use punches with a large flat round head inserted in the punch retainer. No screws are used to hold the punches in position.



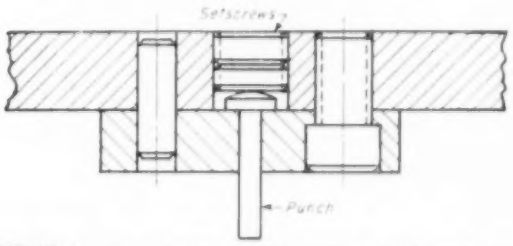
QUILL PRESS FITTED to punch retainer supports small punch (a wring fit) to prevent bending and early breakage. Punch is backed up by two headless setscrews. Punch is made of heat-treated HSS; quill of unhardened water-hardening tool steel



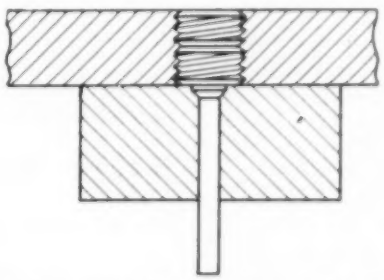
PUNCHES SPACED even closer than shown elsewhere may be backed up by two large setscrews bearing against both punches



CLOSELY SPACED PUNCHES may be mounted directly in the CR punch retainer, which is made as thick as possible. Two socket-head setscrews bear against the punch head



SCREWS for punch retainers should normally be mounted from the top of the punch holder. If a close shut height of the die is required, the screws should be entered from the underside of the punch retainer, as shown



PEENING of the punch head into the retainer should be used only as a last resort. Tendency is to pull out during stripping. Peening is allowable for punches up to 9/32 in.; larger punches should have a turned head

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2 DUAL-PURPOSE OILS (lubrication and cutting)

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SUNICUT 209-S for heavy duty on automatic screw machines

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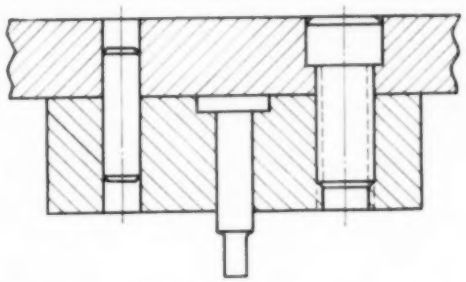
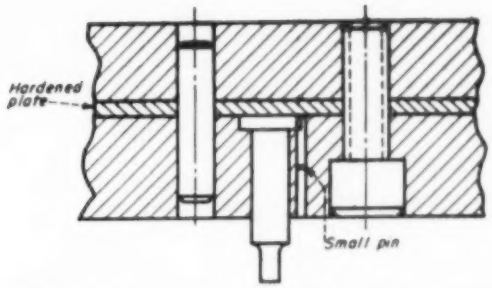
Mounting of Piercing Punches...II



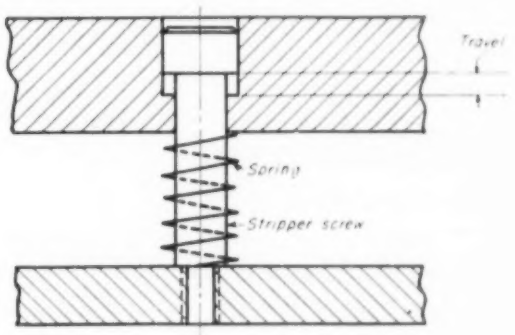
PUNCH HEADS are recessed into the punch retainer, when pierced holes are ½-in. dia or larger. Make punch head flush with or a few thousandths higher than retainer to avoid punch movement. Body of punch should be a wring fit in punch retainer



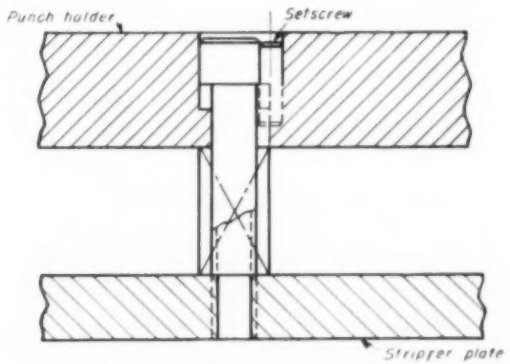
HARDENED backup plate eliminates sinking of punch into punch holder, when piercing thicker gages of steel. A small pin, or "dutchman," prevents the punch from turning

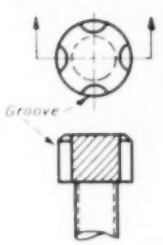
TYPES OF STRIPPER SCREWS

Three types of stripper screws are used in die designs. All of these work on the same principle, but one type may be preferable in a certain die, as compared to the other two types.

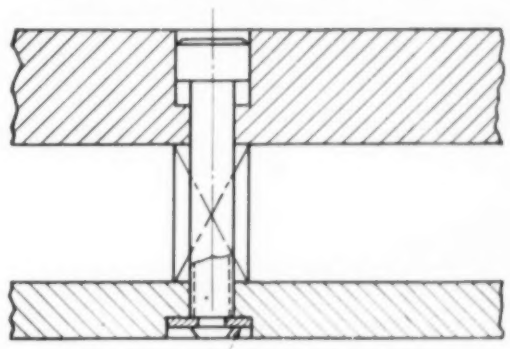


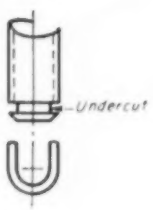
GROUND SHOULDER permits wring or slip fit of screw with punch holder and punch retainer, to guide the stripper plate properly





MILLED GROOVES in head of regular socket-head screw permit insertion of a small locking screw, to prevent the stripper from coming loose in dies where there is considerable vibration





C-WASHER inserted in small undercut at end of socket-head stripper screw is another means of avoiding screw loosening in a die subject to vibration. The washer seats in a counterbored hole in the stripper plate

SMART DOG FANCIERS demand a pedigree!

SMART HOB BUYERS DEMAND A TOOLGRAPH* CHART

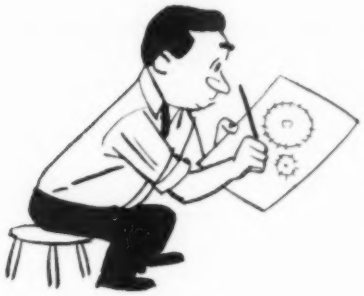
The TOOLGRAPH Chart shipped with every Illinois Tool Works Hob is an electrically produced inspection record . . . positive, not subject to human error . . . that gives hob buyers visual proof of accuracy. And even more, the TOOLGRAPH Chart is a *useful* record of specific hob characteristics that will help assure peak production performance.

Yes, like a champion's pedigree, the TOOLGRAPH Chart actually proves the value of an Illinois Tool Works Hob! It's typical of the many *plus* values that design ingenuity, metallurgy, production skill and experience add to every Illinois Tool Works Tool.

That's why smart hob buyers like the TOOLGRAPH Chart . . . and specify Illinois Tool Works Hobs!

"Headquarters for Engineered Cutting Tools"

TALKING SHOP



Free-Hand or None

GE IS COMBATTING the drafting-manpower shortage by streamlining its drawings. Some 20 to 50% of drawing time has been cut by leaving off frills, excess lines, details, explanations and the like where they're not needed. Extra views are avoided, symbols used instead of details where possible. Free-hand sketching is being encouraged. And if a description will do, no drawing is made at all. One 57-sq ft drawing was cut to 4 sq ft by simplification—without loss of accuracy. Further, it took only a quarter as much time to make. Estimated savings from the practice are as much as $60,000 a year in paper alone.

Plant Planning

ONE TREND in plant planning is to limit size to about a million square feet. Like modern thinking in school planning, this limits plant size and workers (3,000 to 5,000) to a package convenient for management to handle. This assumes production of normal-sized units; obviously a shipyard, railroad-car plant or miniature-bearing builder couldn't be guided by the above area figure.

Also, there is considerable disagreement about headroom. One southern-plant engineer recently said that lower buildings are cheaper; one in Detroit argues that 18 ft under the trusses is far better than 14 ft, costs little more, and eases installation of high machine tools and conveyors. This height problem is a major consideration in "dual-purpose" plants—automobiles don't require the building height that tanks or guns do. Thus automotive executives don't favor the ordnance-commercial interchangeable plant.

New Shell

FELLOWS GEAR SHAPER CO, Springfield, Vt, facing the problem of rebuilding the oldest portion of its shop with least possible interruption of production, came up with an unusual solution. Foundation walls were laid just outside the old ones and concrete pillars cast. Only production interruptions are for casting floors, in which holes are left surrounding the old wood joists. Only a small part of the floor is replaced at a time, so limited numbers of machines are displaced at any given time. Roofing, when the time comes, will be done the same way, without moving machines.

Locating Kink

FOR THE GEAR SHAPER controlled by motion-picture film (*AM* Feb 2, '53, p149), Dr Cunningham designed a fixture that would hold two blanks at once. The locating pin went through the blank at a hub about three times the thickness of the gear itself. Dr. Cunningham found any irregularity in the surface of the bottom gear or a small chip on the fixture would cause the bottom gear to distort the pin and throw the top gear out of line. The solution, which should be applicable to any locating pin that causes similar trouble, was to undercut the pin to leave a bearing area adequate for locating but not great enough to distort the pin.

Ringing Grooves?

IN THE INTRODUCTION to the "What's Ahead" section of our 75th Anniversary Issue last fall we quoted, with some pleasure, the line of Tennyson, "Let the great world spin forever down the ringing grooves of change." A contrary view was related to us by the heads of a firm that had undertaken extensive modernization. At one point in their history, faced with the conservatism of a superintendent who had blocked many new idaes, they resorted to sending him on an extended trip to Florida.

When the superintendent, who was no fool, returned, he rushed down to the plant on Sunday night to see in what ways they had taken advantage of his absence. He prowled soundlessly through department after department until one foreman, no longer able to restrain his curiosity, asked what he thought of it. "I see many changes," said the superintendent, "and some improvements."

Russians Invent Carbide

WORD HAS JUST reached us that in October, 1952, there was held in Tallinn, Estonia, a technical conference for the application of high-speed cutting with cemented-carbide, metal-ceramic and mineral-ceramic tools. Arranged jointly by the Central Trade Union Council, Komsomol, and engineering societies, it was attended by some 300 men—a surprisingly large number for a country still predominantly rural. Most of the lectures dealt with elementary facts on applying carbides, but these elements are worth noting:

1. Hard metals (carbides) were invented by the Russians (!) in 1929/1930 when "Pobedit" was first used (really an imitation of the original German *Widia* metal).

2. Only largest Estonian plants have introduced high-speed cutting, then only in 30 to 60% of the possible applications.

3. Brazed tips are most commonly used but a few clamp-type tools have been received (undoubtedly, the Russians are getting ready to invent these).

4. The heat is on to substitute mineral-ceramic tools to save tungsten, cobalt, tantalum, and niobium, especially in finishing and fine boring. Meanwhile, the Russians are buying carbide tools and tips wherever they can find them.

Swedish tests prove out radioactive tool experiments

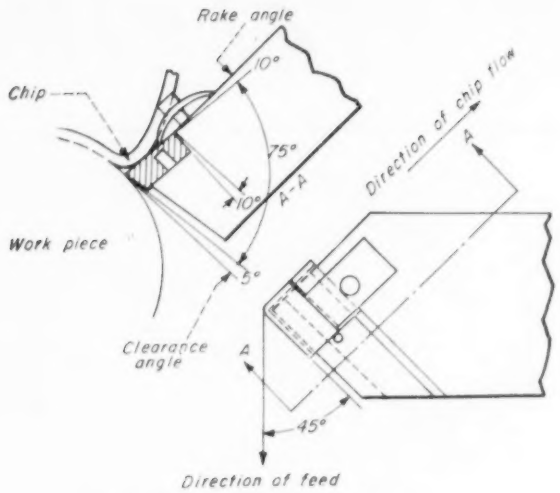


Fig. 1—Characteristics of the cutting tool

Isotope-tracer measurements proved more accurate than microscopic examination. Details of tool design are shown and results with two qualities of European carbide

IRRADIATED food products are rapidly being rivaled by irradiated carbide cutting tools. Since the original announcement of the use of radioactive toolbits at Cincinnati Milling Machine Co in *AM* for Dec 24, 1951, laboratories in other countries have been testing the method. We have just seen a report from the Royal Institute of Technology, Stockholm, Sweden, on work by B Colding and L G Erwall which proves out the work of M E Merchant and E J Krabacher. These researchers report isotope-tracer measurements are more accurate than microscopic examination and show a constant rate of tool wear.

Their work was done with two grades of carbide, one 7.2% Co, 3.5% TiC, 2.5% TaC, and 86.8% WC; the second 9.3% Co, 4.7% TiC, 0% TaC and 86.0% WC. Cuts 0.078 deep at a feed of 0.020 ipr and a speed of 328 fpm were taken on a 7¾-in-dia billet at 220 Bhn of this composition: 0.58-0.60% C, 0.80-1.10% Mn, 0.20-0.24% Si, 0.04% P max, and, 0.04% S max. Each tool tip was ground to a nose angle of 90°, set at 45° side cutting-edge angle, with 5° clearance and 10° side rake. Toolbits alone were irradiated, then clamped with a top spring plate (to avoid the need of brazing) into a nose channel and backed by a pin (Fig. 1). With the rake indicated, preliminary experiments showed a transfer of at least 5 mg of tip material in 20 min, with total cutting of 6560 ft of chips. Machining was done by remote control; operators were protected by a shield and an exhaust fan and controls were extended through the shield. It is interesting that the filter in the fan showed no contamination after the experiments. Tools were irradiated at the British atomic lab.

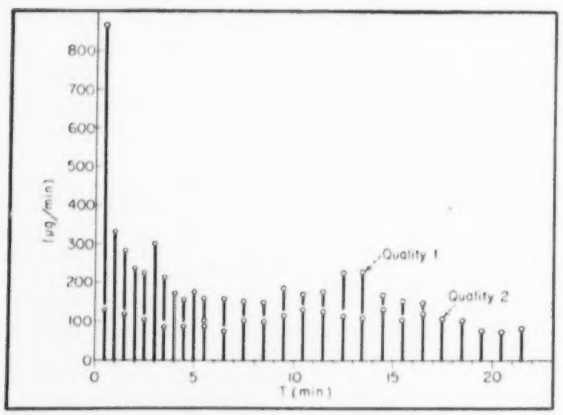


Fig. 2—Rate of material transfer from tool tip to chips

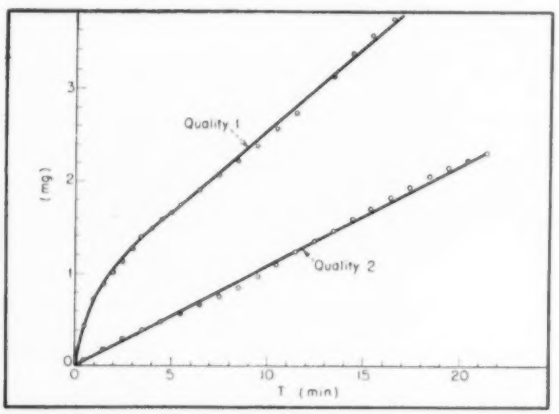


Fig. 3—Total wear of tool edge related to time. "Quality 1" is the first grade of carbide, "Quality 2" the second

Carbide tools ground without a diamond wheel

BY ERNEST SPERISEN, Master Mechanic
GISHOLT MACHINE COMPANY, Madison, Wis

In finishing carbide tool bits, it has been usual practice to rough with a silicon-carbide wheel and finish with a diamond wheel. With reported shortages of diamond bort, it seemed logical to investigate use of a fine-grit silicon-carbide wheel as a substitute for the diamond wheel. Our 2-year test period substantiates claims now being made by several manufacturers of silicon-carbide grinding wheels.

In analyzing the work of the tool, it can be seen that only the small surface area, *A* and *B* (Fig. 1), need be finish-ground. Actually areas *A* and *B* are the only surface in contact with the moving chip, thus are the only surfaces doing any work. This greatly simplifies the finishing operation.

Surfaces *C*, *D* and *E* are rough ground in the conventional manner. Surfaces *A* and *B* are then ground with a fine-grit silicon-carbide wheel set at an angle of 1° less than the rougher. This confines finishing to just the working surfaces. The very cutting edges are then honed with a diamond stick. The change in the shape of the point on the tool is shown in Fig. 2, while a schematic of the chip forming in a turning cut is shown in Fig. 3.

Cost savings are particularly interesting. Savings of better than $500 per month have been made. We formerly used two diamond wheels per month, at $206 each, for carbide turning and facing tools. Cost was thus $412. We now use ten silicon-carbide wheels per month at $5.10 each, for the same amount and kind of work, at a cost of $51.

This saving of $361 has been made just on the turning and facing tools. By using the same principle on finishing milling cutters, an additional monthly saving of $213.67 has been realized. In the case of the milling cutters, it was found that two silicon-carbide wheels would replace one diamond wheel.

Although these tests have been carried on continually for the past two years, there has been no noticeable effect on tools finished in this way. Sharpening takes no more time and is no more frequent.

Perhaps the greatest saving is not for the individual user, but for our industrial nation. Crushing bort accounts for approximately 75% of all the industrial diamonds we use, and 80% of this amount is used in diamond-grit wheels. If we could convert all diamond-wheel work to silicon-carbide wheels we should be able to save some 8 million karats of diamond bort per year.* At the 1952 rate, this should cut our minimum essential import requirements by half.

(Users of diamond wheels will be interested in the booklet SALVAGE OF INDUSTRIAL DIAMONDS. Write to Superintendent of Documents, Washington 25, DC, for pamphlet 1952-0-992 278, enclosing 10¢)*

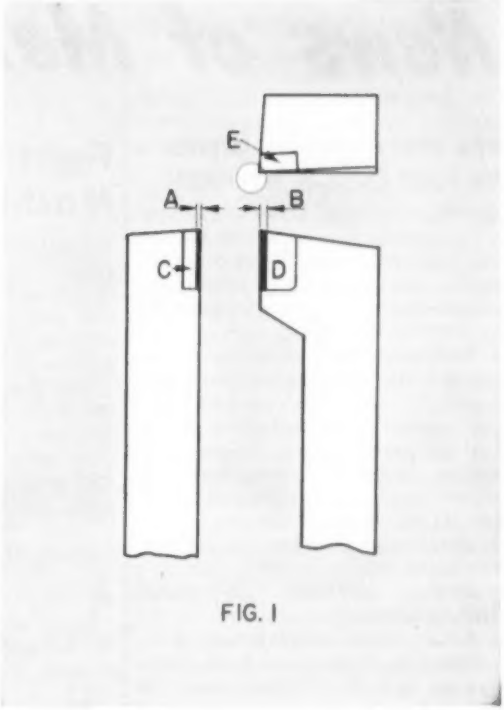


FIG. 1

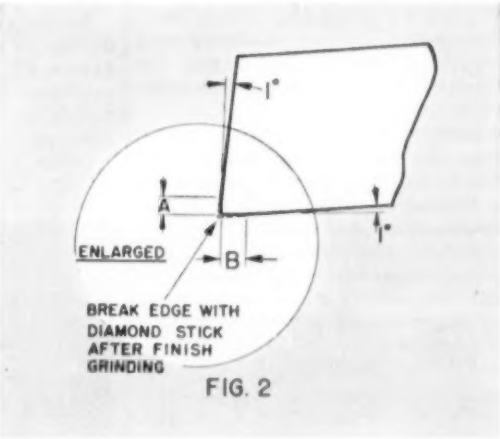


FIG. 2

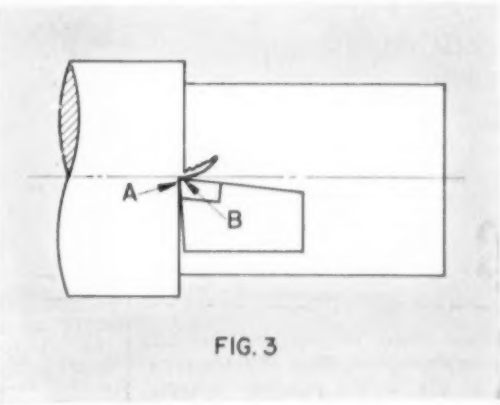


FIG. 3

News of Metalworking

NPA OKAYS UNRATED ORDERS ON SOME CRITICAL MACHINES

WASHINGTON — Users may now place unrated orders for the following machine tools, heretofore reserved exclusively for rated customers, according to a new amendment to NPA Order M-41:

- **Boring machines:** (a) vertical boring and turning machines 54-in. and larger (b) vertical boring and turning machines, all automatic cycle (c) horizontal boring, drilling and milling machines — table, floor and planer type—4-in. spindle and larger (d) jig boring machines.
- **Die-sinking machines:** (a) manual (b) automatic.
- **Drilling machines:** (a) radial drilling machines.
- **Gear-Cutting machines:** (a) gear-hobbing machines—6-in. pitch diameter by 10-in. face and smaller.
- **Grinding machines:** (a) long-bed surface grinders—60-in. travel and larger (b) table-type single-head nonautomatic rotary surface grinders—30-in. capacity and larger. (c) jig-grinding machines (d) face-coupling grinders.
- **Lathes:** (a) duplicating and tracer type (b) turret lathes, saddle type, 3½ in. bar capacity and larger.
- **Milling machines:** (a) No. 4 and larger—knee and column type and bed type (b) planer or rail type mill (c) duplicating or copying type (d) skin-milling machines (e) spar-milling machines, and (f) jig-milling machines.
- **Planers:** (a) 60-in. x 60-in. double housing and larger (b) 48-in. open side and larger.
- **Shapers:** (a) breech ring shapers.

AIR FORCE TO SELL EXCESS EQUIPMENT

WRIGHT-PATTERSON AFB, OHIO —Air Materiel Command has announced it will resume sale of excess equipment to the public. Sale of such equipment had previously halted with outbreak of Korean hostilities. First bids will go to other Armed Services, then to Federal agencies, after that the public will get its chance to buy. Equipment for sale, the Air Force says, will range from hairpins to complete aircraft engines. Most engines available are in the obsolete category.

Fight Looms Over Leasing US-Owned Machine Tools for Non-Defense Work

WASHINGTON — A fight may be shaping up here over the availability of the government-owned machine tool inventory to manufacturers of civilian products and other non-defense businesses.

The inventory, administered by the National Production Authority, consists of about 34,000 idle or surplus government tools, valued at $500 million. Under present regulations, the tools are leased through military channels to defense contractors and subcontractors. Average monthly rental: 1% of acquisition cost.

Tools are also leased to certain defense-supporting industries, either directly through NPA or through the Small Defense Plants Administration. More than 10,500 have been leased to date.

Behind proposals to accelerate leasing or sale of the tools are Rep Shafer (R., Mich) and others who consider the equipment "an untapped source of revenue for the government."

Others plugging the idea are NPA officials, who estimate about 75% of the tools are not suitable for defense work; Small Defense Plants Administration; used machine tool dealers who want to participate in planning a disposal program; and many of the smaller metalworking companies.

Opposed is the Munitions Board, which wants to tighten, not loosen, tool leasing eligibility requirements. The Board argues that liberalization of leasing will injure the market for new machine tools and give competitive advantages to metalworking firms who can charge the leased tools to expenses, not investment. Also under Board fire is NPA's estimate on the tools' unsuitability for defense work.

No quick decision on this is upcoming. Defense agencies are undergoing reorganization—no one knows where final authority will rest on the question. Rep. Shafer also plans to look into possible revision of the National Industrial Reserve Act, the bill that created the machine tool reserve in the first place.

(See this issue's editorial, "For Defense Purposes Only," p 129).

FIRST JET ENGINE PARTS in production at Chrysler Corp's Jet Engine Plant near Utica, Mich, are turbine discs for J-47's. A Chrysler machinist is shown making a final adjustment on one of eight vertical turret mills recently installed at the Utica plant for machining the discs

Russia's Machinery Output Soars —So Russia Says

NEW YORK — Soviet Union's machinery industry topped its production goals in 1952, according to an official announcement in the Russian press. The Ministry of Machine Construction last year achieved 100.5% of plan, while Soviet industry as a whole reportedly attained 101% of production plan.

All Production Up

Although specific figures weren't given, the Russians announced the following percentage gains in 1952 over 1951.

Metal cutting machines 3%; oil machinery 44%; chemical equipment 28%; thread-makers 18%; looms 39%; metallurgical equipment 12%; ball bearings 17%.

Heavy duty single-bucket excavators 7%; multiple-bucket excavators 22%; steam turbines 8%; large hydro-turbines 24%; turbo-generators 30%; hydro-generators 38%; large electric machines 7%.

Automatic loaders 3%; electric motors 6%; calculating machines 53%; tractors 7%; beet harvesters 19%; grain harvesters 20%; threshing machines 7%; automobiles 7%; railroad rails 53%.

According to Soviet officials, some 600 important new types of machines were developed last year—in all, the Soviet government approved 800,000 inventions, technical improvements and innovations leading to better productive processes.

Listed among new machines were more-economical hydro and steam turbines; high-capacity metal rolling equipment; machines for welding heat-resistant alloys and low-carbon steel; heat-treating furnaces, and more than 200 new types and variations of metalworking and forging machines.

One heavy vertical boring and turning machine, in use at Novosibirsk, is claimed to be able to handle pieces up to 4x7 meters, weighing "tens of tons."

Capital construction in machine building increased 11% last year, the Russians claim. Productivity in Soviet industry as a whole is claimed by Russia to have increased 7% in 1952 over 1951.

A N Goddard Dies

Archibald N Goddard, founder and chairman of Goddard & Goddard Co, Detroit milling cutter engineers and manufacturers, died Feb 24 at Key West, Fla. He had retired in 1947 as company president.

Metalworking Abroad

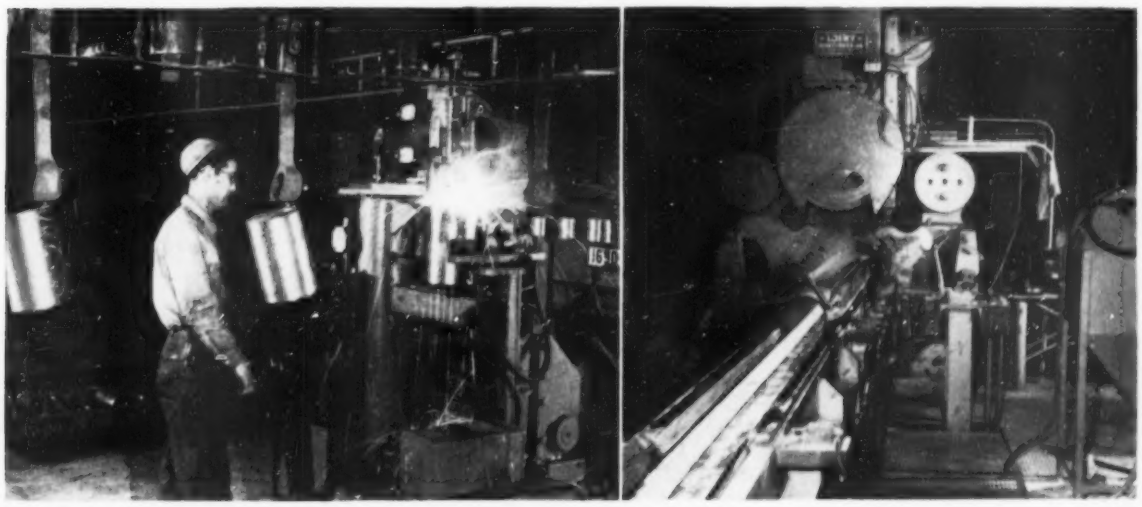
(By McGraw-Hill World News)

Britain will manufacture jeeps under terms of an agreement between US's Willys-Overland Motors and England's Standard Motors. Entire jeep will be tooled in England, will feature interchangeability of all parts with US jeeps. In reciprocation, Willys will market "certain new products" of Standard Motors in this country. One of these is believed to be a sports car.

French shipyards are building 32 large tankers with a total tonnage of 800,000 metric tons. Foreign orders account for only seven: six for the US—five of 34,500 tons and one of 19,800 tons; one for Chile, 17,500 tons. Twenty-three tankers will be turbine-powered, nine will be diesel-powered.

Plastic shipping covers, tailored to measure and heat-sealed, are being tried out on machinery shipments by England's Leyland Motors. Covers are made of Alkathene, a moisture-proof, acid-resistant, rugged translucent thermoplastic. Before sealing, bags of silica gel are hung around the engine to absorb moisture trapped within the covering.

Australia's buying trend is toward small cars, according to Sir Reginald Rootes of England's Rootes companies, automobile manufacturers, who recently completed an extensive survey of the Australian market. Large US-type cars are out, he claims.



EXTRUDING STAINLESS STEEL at US Steel Corp's National Tube Div, Gary, Ind. Left: billets are electrically welded to conveyor hanger-studs, are then carried through gas furnace and barium-chloride bath to press-charging buggy. Weld is severed, billet is positioned and rammed through 2500-ton hydraulic press (right) to produce 35-ft steel tube.

SHORT RUNS ...

More on Canada's fabulous "flying saucer"—it's still very much under wraps—may be only a gleam in the designer's eye. But rumors are flying almost as fast (1500 mph) as the CF-100 is expected to. The rumors: it will be saucer-shaped, with the pilot sitting in the center in a plastic bubble. Saucer's rim, driven by jet engines, spins at terrific speed to achieve vertical take-offs without need for runways. Once in the air, another set of engines takes over for forward propulsion. If the CF-100 works, Canadians say it will put today's aircraft on the obsolete list.

• **That rumor** going the rounds that CIO Steel Workers may shift to AFL just doesn't stand up. They're much more likely to switch to United Mine Workers, which built up the steel union in the 30's. But that's not in sight, either.

• **More and more women** are going into defense work, says the Dept of Labor. More than a third of the workers added to the manufacturing work force between Sept '50 and Sept '52 were women. Five times as many women were employed by aircraft industries at the end of the two-year period, three times as many in ordnance.

• **President Eisenhower's Reorganization** Committee, headed by Nelson Rockefeller, held its first meeting to overhaul the Defense Dept early this month. They're due to report to Defense Secretary Wilson by April 30. Object is to pare the sprawling military services. Former Defense Secretary Lovett is a member of the Committee.

• **Navy recently let contracts** for building 102 63-ft aircraft rescue boats, costing around $65,000 each. Sixty of the craft will be built by Deer Island Yacht Basin, Stonington, Me.; 23 by Sagstad Shipyards, Seattle; balance by Detroit Basin, Inc.

• **Merger is being considered** between Crosley Motors and Aerojet Engineering Corp, subject to Crosley stockholder approval on March 27. New company would be tilted Aerojet-General Corp.

Free Trade or Higher Tariffs? Capitol Hill Girds for Hot Fight

WASHINGTON—US metalworking industries may be in for tough competition from abroad . . . and the answer seems to be: get ready to sell more in export markets.

The issue of higher or lower tariffs is a hot one for the Eisenhower administration. The President's first action was on the side of free trade, when he tentatively ruled against a Tariff Commission recommendation that duties on briar pipes be raised because imports are injuring the domestic pipe-making industry.

Briar pipes may not seem important in themselves, but the decision was interpreted on both sides of the fence as indicative of which way Eisenhower will go. It's still too early to say for sure just how far the administration will lean toward lowering US tariff walls to further international trade. There are also moves afoot to cut customs red tape, end "Buy American" legislation and reduce other barriers to imports.

In favor of free trade instead of aid are such widely divergent organizations as the National Association of Manufacturers, CIO, US Council of the International Chamber of Commerce, and two of three major farm groups. The AFL is wavering on the question.

US metalworking industries are divided on the issue.

Henry Ford II, for instance, jumped on the free trade bandwagon with a call for progressive scrapping of all tariffs and trade barriers. Most auto makers seem to fall in with his thinking.

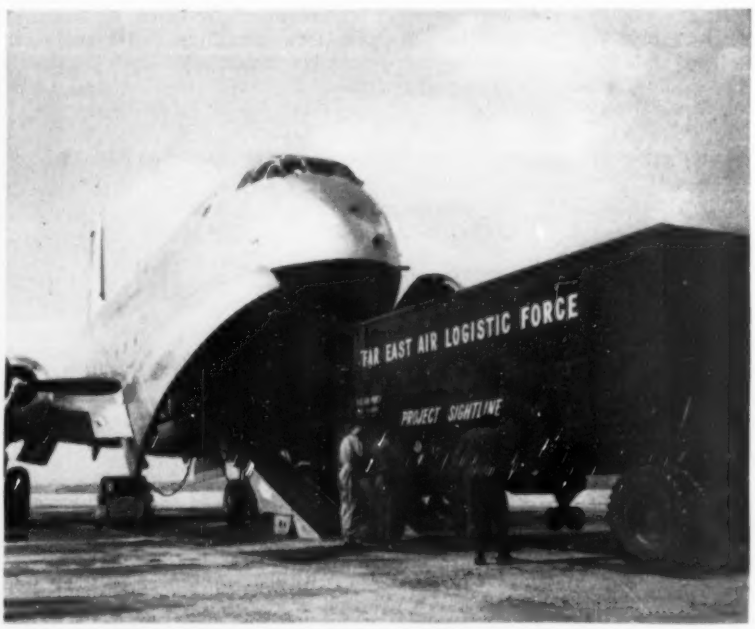
On the other hand, makers of textile machinery, motorcycles, bicycles and many other items want more, not less, protection from imports from Japan and Europe.

Which way the trade winds are shifting should be evident by June.

Here are the tipoffs:

• **The President's appointments** to fill two vacancies on the Tariff Commission. If they're high tariff men, signs point to more protection: if they're free traders, it would point to low barriers.

• **How strong the White House's stand** on lower trade barriers will be when the Reciprocal Trade



FLYING REPAIR SHOP, designed for on-the-spot maintenance of complex aircraft systems, boards a Korea-bound plane at Wright-Patterson Air Force Base, Ohio. Airborne shop can be loaded on plane in 30 min, carried to trouble spot. Unit can put a bombed repair depot back into action in 2 hours

Agreements Act comes up in Congress this spring. Republican congressmen are set to write new restrictive clauses into the bill if Eisenhower doesn't put his foot down.

Liberal trade partisans want a new US commercial philosophy — based on the nation's economic interest, not on special marginal business interests, as at present. They argue the first businessman's administration in 20 years should do the job since big business has the greatest stake in increased world trade.

Free traders have an uphill fight: most Republican Congressmen favor increased protection for the domestic market, want to raise trade barriers. The President looks like the only man in the administration who leans toward free trade, possibly excepting Treasury Secretary Humphrey.

Silicon Bronze Weldment Replaces Cast Iron in Venturi Fabrication

SOUTH BOSTON, MASS.—For the first time, welded silicon bronze is replacing cast iron in fabrication of Venturi cones—used in measuring tunnel water flow.

Key factor in making the silicon bronze cone at Daniel Russell Boiler Works here is a new bare-wire-electrode-within-an-inert-gas-shield arc welding process. Marketed commercially as the Aircomatic process by Air Reduction Co, New York, this new development has solved many problems attending welding of aluminum, stainless steel, nickel, copper, etc.

The cone, to be used in measuring flow through New York City's Neversink Tunnel, must be able to handle 300,000 gallons per minute without failure, requiring that it meet severe corrosion and pressure requirements.

Russell Boiler Works, subcontracting for Builders-Providence, Inc, used American Brass Co's $\frac{5}{8}$-in. Everdur ‡1010 plate. Cone was made in two sections: (1) a small section, 4 ft long, of a single plate, and (2) a larger section 12 ft long made of three plates with three longitudinal seams. Girth and seams are double-V groove butt joints with $\frac{1}{8}$-in. land, $\frac{1}{8}$-in. opening and 60 degree included angle. Small section's small end band and large end's brackets are fillet welded—all welds on the inside are ground smooth. Completed cone is 8 ft in diameter, tapering to 5 ft, 5 in. Overall length: 16 ft.

Applied manually, the Aircomatic process used 1/16-in. Everdur ‡1010 filler wire and argon shielding gas at a rate of 50 cfh. Wire feed speed was 135 in. per min. Amperage: 165.

As reported by J F Buerkel and P E Woodward, Air Reduction technical representatives, examination of the completed cone revealed no cracking in any of the welds.

Plant Expansion

Warner and Swasey Co, Cleveland, recently put its $1\frac{1}{2}$ million plant at New Philadelphia, Pa., into operation. The 137,000 sq ft plant has been added to W & S's facilities for making parts and minor assemblies to be shipped to the company's main plant in Cleveland for assembly into complete machine. Already in operation, since 1950, is W & S's Gradall earth moving machine plant at New Philadelphia. Combined with the new plant, Warner and Swasey's operations there will employ about 680 people.

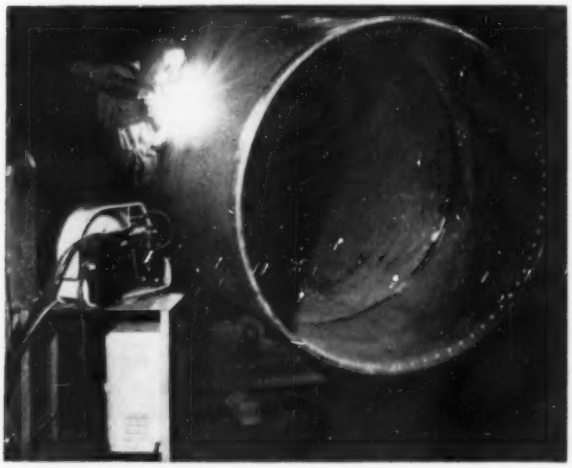
General American Transportation Corp has started construction of a $500,000 chemical and petroleum tank manufacturing plant at Provo, Utah, adjacent to US Steel's Geneva Plant.

Charles D Briddell, Inc, has started cutlery production at its new $750,000 plant in Crisfield, Md. The new plant replaces one which was totally destroyed by fire in 1951.

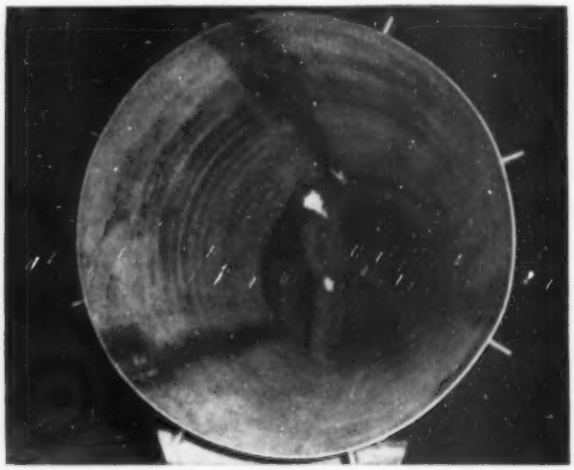
Metalwash Machinery Corp has expanded and modernized its main offices at its Elizabeth, N J, pickling and drying machinery plant.

Ungar Electric Tools, Inc, manufacturer of industrial soldering handles, has completed a $200,000 plant at Venice, Calif.

Fairchild Engine & Airplane Corp is planning one of the world's most modern jet aircraft manufacturing plants adjacent to Roosevelt Field, L I, N Y. The new plant will be Fairchild's fifth on Long Island.



WELDING VENTURI for New York City's Delaware Water Supply System, using inert gas shield manual arc process



FINISHED CONE ASSEMBLY viewed from large end, showing welds ground smooth. Cone carries 300,000 gpm.

Business Items

Kropp Forge Co, Chicago, recently announced that its unfilled tonnage backlog is the highest in its history. Operations at **Kropp Forge Ordnance Co,** Melvindale, Mich, are at an all-time peak. **Kropp Steel Co,** Rockford, Ill, is working at capacity.

General Electric Co has established two new operations within its Aeronautics and Ordnance Systems Div —**Guided Missiles Dept** and **Aircraft Products Dept.** The former will be at Schenectady and the latter at Johnson City, NY.

American Brake Shoe Co is expanding its powder metallurgy product manufacturing facilities at its Hillburn, N Y, plant.

Heinrich Tools, Inc, is the new name of **National Machine Tool Co,** Racine, Wis. The firm will continue to manufacture shears, rod cutters, punches, screw-type drill press vises, locks.

A M Sargent, founder and former president of Pioneer Engineering & Mfg Co, has opened a consulting engineering service at 10120 West McNichols Rd, Detroit. He is past president of ASTE.

Romulus Tool & Engineering Co, 36051 Goddard, Romulus, Mich, has been formed by Joseph Player and Edward Halik, both formerly of Turchan Follower Machine Co, to build jigs, fixtures, controls and special machinery.

Commercial Shearing & Stamping Co, Youngstown, Ohio, has organized a subsidiary, **Commercial Shearing, Ltd,** Hamilton, Ont, to handle its Canadian orders.

Solar Steel Corp, Cleveland, recently acquired **United States Products Co,** Worcester, Mass., increasing Solar's facilities for distributing flat rolled, bar and tube steel products in the New England area.

Solar Aircraft Co, San Diego, Calif, has received $500,000 contracts for manufacturing T-29 aviation trainer exhaust systems and augmentors for T-29's and Convair-Liners from Consolidated Vultee Aircraft Corp.

Bliss & Laughlin, Inc, will shortly open a plant for production of cold finished steel bars at Eight Mile Rd & Hoover Ave, Detroit.

Small Metal Plants Face Defense Sub-Contract Cuts: Sen. Thye Warns

WASHINGTON — With big prime military contracts placed after Korea coming to completion, small metalworking companies on subcontract work face serious cutbacks during the coming months. That's the warning sounded by the Senate Small Business Committee, headed by Sen. Edward J Thye (R., Minn).

The committee urges that new prime contracts be channeled to small metalworking companies, pointing out that the military budget will stay at a record high through most of this year.

The implication: Small Defense Plants Administration, scheduled to get the axe in June, is needed to keep an eye on small business participation in defense production.

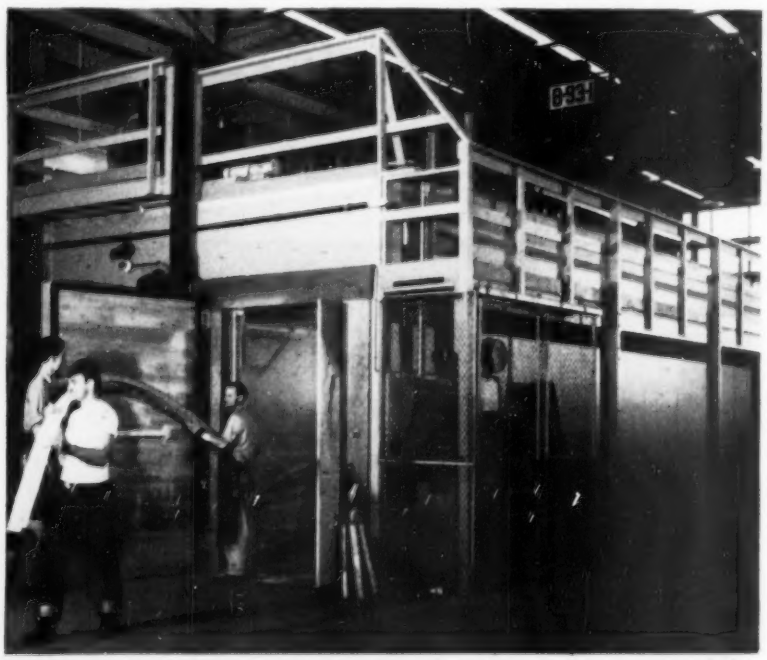
The Senate Banking Committee, which is considering defense mobilization legislation and a proposal to extend SDPA's life for another year, agrees.

The Small Business Committee, in its annual report, condemned the government for allowing machine tool shortages to hold up military production as late as a year after the start of Korea. The shortages, the committee said, were "avoidable and stemmed from unrealistic programming and gross mismanagement from the start."

Machine tool bottleneck—the Senate report names three government faults responsible for it:

- **"Helter skelter liquidation** of surplus machine tools after World War II," leaving machine tool builders unable to meet post-Korean demands without help from Washington "which was not forthcoming."
- **Failure to grant price relief** and metals priority assistance until August, 1951.
- **Defense Dept's failure** to draw up a master preference list for defense contracts until Jan '52.

"The machine tool problem now seems reasonably solved," the committee report states caustically, "and that chaos in this vital industrial field did not cause grave consequences is a tribute not to the wisdom of our defense production officials, but to our national luck."



DEEPFREEZING AIRPLANE PARTS BETWEEN MANUFACTURING OPERATIONS at Lockheed Aircraft Corp, Burbank, Calif. Aluminum alloy, softened by heating to high temperatures for metallurgical purposes, can be kept soft for forming if quick-frozen soon after heating. Short runs and re-setups are minimized

Internal Grinding of Titanium Now Possible

BY E J KRABACHER, Research Engineer, THE CINCINNATI MILLING MACHINE CO

PERHAPS the greatest of many difficulties encountered in machining titanium alloys has been in internal grinding. All precision grinding of titanium has been difficult because of extremely rapid wheel loading and resultant wheel wear. With conventional grinding wheels, fluids and practices, ratios of the order of one cubic inch of metal removed to one cubic inch of wheel worn away have been common, together with very poor surface finish and, often, troublesome chatter. Through patient research in the development of special techniques, large improvements have been effected, particularly in surface grinding and cylindrical grinding, where conditions appear to be more favorable. To date, however, no effective internal grinding of titanium has been reported.

Internal-Grinding Problems

Internal grinding is particularly difficult with titanium. Because of the small size of wheel, wheel wear is especially important. While the wearing away of one cubic inch of wheel on a surface-grinding or external-grinding operation may be only a small percentage of the wheel volume, in internal grinding it may be half or more of the wheel. This emphasizes the need for a high *grinding ratio* (cu in. of metal removed per cu in. of wheel wear) in internal grinding, if size and straightness are to be readily controlled. Also, because of the small circumference of the wheel, each active grit makes many more contacts with the work in a given period of time than in the case of external or surface grinding, hence does much more work. Therefore, a much smaller total volume of metal can be removed before excessive dulling or loading of the wheel is encountered.

As a result, until now, in all attempts at internal grinding of titanium with any usual combination of grinding wheel and fluid, the wheel either loads or breaks down so rapidly that removal of any significant amount of metal becomes impractical and obtaining of a satisfactory finish almost impossible.

Basic Considerations

Research into the physics of the machining of titanium, carried out in the research laboratories of the Cincinnati Milling Machine Co, indicated that the fundamental difficulties in titanium grinding are the high mutual solubility of titanium in most other metals and refractories at elevated temperatures, and the very high temperatures occurring in chip-forming processes. Thus the individual grinding grits are subjected to a combination of high temperature and the severe solution action of titanium. This can result in direct attrition and dulling of the grits by solution, or in "solution-bonding" of titanium to the grits, causing "capping" and resultant fracture of the grits. The relative amount of each type of wear depends on such wheel-structure factors as the type of grain and strength of bond.

Three possibilities therefore seem likely to improve the grinding of titanium. The first is to impose, by action of a cutting fluid, a low-shear-strength solid film between the surface of the grit and the titanium chip, to reduce or prevent solution by reducing or preventing direct contact between metal and grit, even at the very high temperatures involved in grinding. (The melting point of titanium is 3150 F, which alone sets the upper limit for the temperatures at the chip-grit interface in grinding this metal). The second possibility is to manufacture a grinding wheel from a refractory which is not mutually soluble with titanium (if such exists), or to develop a wheel of conventional refractories which will, by the nature of its structure, reduce to a minimum the wear by attrition and fracture. The third possibility is to reduce the grinding temperature (temperature at the chip-grit interface). This reduction in temperature reduces the tendency for solution between the grinding grit and the titanium metal, thus reducing the attrition or capping of the grits.

Three Means

From our previous research in chip formation, it appears that there are three primary means of lowering the grinding temperature: 1) reduction of the amount of heat generated in the grinding process by the use of a more effective grinding fluid, (ie, one capable of the interposition of a low-shear-strength solid film between the contacting surfaces of grinding grit and chip); 2) more rapid dissipation of the heat which is generated, by applying an effective coolant, and 3) the reduction of the rate of heat generation by reducing grinding-wheel speed.

It is evident from an evaluation of these three means of lowering grinding temperature that the first is by far the most desirable. If we can eliminate most of the heat generation at its source, our problem is most directly and satisfactorily solved. It is evident also that the third means of lowering grinding

Table I . . . *GRINDING RATIOS FOR INTERNAL GRINDING*

Work Material: Ti 150A
Grinding Fluid: Cimcool Titan
Grinding Wheel: Cincinnati Exp. No. 1140 – 1¼ x 1¼ x ⅜
Grinding Wheel Surface Speed: 4000 fpm
Work Speed: 75 fpm
Internal diameter of work: 3¾ in.

Metal Removal (in. on dia)	Wheel Wear (in. on dia)	Grinding Ratio Volume of titanium / Volume of wheel
0.144	0.0045	72
0.148	0.0030	111
0.060	0.0017	114
0.056	0.0018	98
0.088	0.0020	97

temperature is the most undesirable. Reducing the grinding-wheel speed undoubtedly reduces the rate of heat generation, consequently lowering the grinding temperature under similar conditions of cutting-fluid application. It must be borne in mind, however, that reduction of grinding-wheel speed results in a corresponding reduction in rate of metal removal. We should not therefore look to reduced grinding-wheel speeds as the ultimate solution to our problems, but rather to a combination of grinding fluid and grinding wheel which will give results in line with good grinding practice.

Application

Research on the cylindrical (external) grinding of titanium in these laboratories resulted in improvement of this operation from one giving very poor finish, considerable chatter and a grinding ratio of one or less, to one giving chatter-free finishes of 15 microinches or better, and acceptable grinding ratios (ranging from 15 to 20 for various operating conditions).

This background of information and experience was used to launch an investigation of the more difficult internal grinding. All tests were run on a Cincinnati 10-in. universal grinder equipped with a standard internal-grinding attachment. Test pieces were of Ti 150A with an internal diameter of approximately 3¾ in. All tests were made under plunge-grinding conditions with a width of cut of ¾ in. The grinding wheels were 1¼ x 1¼ x ⅜. Cutting fluid was applied by conventional methods, and only the best fluids developed in the external-grinding research were utilized. Initial tests with conventional internal-grinding wheels proved very disappointing, with very poor finish, severe chatter and grinding ratios of 4 or less. Therefore the grinding wheel itself was studied, and various combinations of wheels and special fluids were investigated. Out of this came the discovery that a particular combination of grinding wheel and grinding fluid gave excellent finish, no chatter, and startling values of grinding ratio ranging from 70 to 115! The wheel-fluid combination producing this result was a Cincinnati experimental wheel No. 1140 (which will be produced commercially in a few selected sizes) and a newly developed fluid which will be known commercially as Cimcool Titan .

While these results may seem phenomenal to anyone who has attempted the internal grinding of titanium, they have been consistently duplicated in numerous tests. Typical data are presented in Table 1. From this table it may be seen that in addition to the very high grinding ratio, a stock removal of 0.150-in. on diameter has been obtained on a 3¾-in.-dia workpiece without redressing the wheel. This is an important practical consideration; too often data on the amount of stock removed before redressing have been omitted in the reporting of grinding investigations on titanium.

External Grinding

The foregoing discovery in internal grinding led to a further study of the external-grinding operation. Again a particular combination of wheel with the new fluid gave outstanding results, with grinding ratios much better than previously obtained. Details of this development and the results will be reported in the near future.

MACHINE TOOL ELECTRIFICATION FORUM SET FOR APRIL 14-15

BUFFALO — Annual Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corp, will be held here April 14 and 15 at the Hotel Statler and at Westinghouse's Control Division. Automation requirements of major users of machine tools, and ways in which machine-tool builders can fulfil them, will be discussed.

Distributors Named

Thomas F Sears Co, Bellaire, Texas, has been named to handle sales and engineering service for **Pioneer Pump Div, Detroit Harvester Co,** in Texas and Louisiana.

Maintenance Engineering Corp has opened an office in Dallas, Texas, to handle products of **Lukens Steel Corp,** and its divisions, **By-Products Steel Corp,** and **Lukenwald.**

Stewart-Warner Corp's Instrument Div, Chicago, announces three new distributor appointments: **Alemite Co,** Boston; **Stewart-Warner Alemite Sales Co,** Hartford, Conn; and **Alemite Co,** Des Moines.

Saterlee Co, Minneapolis, has been appointed by **Clearing Machine Corp,** Chicago, to distribute its entire line of presses in Minnesota and Northern Wisconsin.

Clyde Smith of Elyria, Ohio, will handle sales of **Adamas Carbide Corp's** line of tungsten carbide tool tips, dies, and parts in southern Ohio.

G D Machine Co, Tucker, Ga, will distribute **Kurt Orban Co's** line of German-made machine tools in Georgia, Tennessee, North Carolina, South Carolina, Florida and Virginia.

Air Reduction Sales Co has opened a liquid oxygen plant at Butler, Pa., and has started delivery of oxygen to industrial customers in that area and throughout the Midwest.

SAFETY TRAINING FILM FOR FORK TRUCK DRIVERS, now available on a loan basis from Clark Equipment Co, Battle Creek, Mich, shows how to avoid common materials handling accidents. Filmed in various factories, the 30-min. sound movie has its villain, Willy the Cowboy (pictured here in a characteristic wind-up of his efforts to drive a fork truck like a hot rod)

Fred Rimmler

F S Blackall III

Victor Brown

T V Picraux

Names in the News

Fred Rimmler has been appointed plant manager for John Volkert Metal Stampings, Inc, Queens Village, L I, N Y. With Volkert since 1949, he was formerly employed by RCA Mfg Co, Inc.

F Steele Blackall, III, has been appointed assistant general manager of Taft-Peirce Mfg Co, Woonsocket, R I. Mr Blackall, who was formerly assistant superintendent of T-P's Contract Div, will continue to serve as assistant treasurer and a director of the company.

Gordon M Sommers has been named chief engineer of Clearing Machine Corp's Hamilton, Ohio, plant, where he will be responsible for design of power presses.

Curtis L Bates, for more than 10 years associated with Northrop Aircraft, Inc, has joined Ryan Aeronautical Corp, San Diego, Calif, as assistant director of engineering. Mr Bates has been supervisor of stress engineering on the P-61 Black Widow and the B-35 and B-49 Flying Wings. Ryan's chief aerodynamics engineer, **Peter F Girard,** is on leave of absence to attend the Navy's Flight Test School.

John E Mattos has been named manager of heavy products sales for US Steel's Columbia-Geneva Steel Div, San Francisco.

Russel J Keller has joined Cleveland Welding Co, subsidiary of American Machine & Foundry Co, as engineering assistant to the president. He was formerly technical supervisor of B F Goodrich Co's Aircraft Wheel & Brake Div.

Victor Brown has been appointed a vice president of Kropp Forge Co, Chicago. Mr Brown, who joined Kropp in 1942 as chief metallurgist, has been technical director since 1945 and a director of the company since 1947.

G A Burridge, secretary and director of Burton, Griffiths & Co, Ltd, has been named a director of BSA Tools, Ltd, Birmingham, England. **F A Janes,** BSA's sales manager, has been appointed a director of Burton, Griffith & Co. **J L Parker** succeeds **F H Harris,** resigned, as BSA's works manager.

Joseph D Harbaugh, manager of Chevrolet's Detroit manufacturing plants, retired recently after 47 years in the automobile business, 34 of them with Chevrolet. Mr Harbaugh started his automobile career in 1906 as a time clerk with Maxwell Motor Co in his home town of New Castle, Ind. He was division superintendent of Central Gear Co and retained that position when it became Chevrolet Gear & Axle Div in 1923.

Sam R Watkins, assistant vice president of American Brake Shoe Co's Brake Shoe & Castings Div, has been named executive vice president of Brake Shoe's National Bearing Div. He will transfer to the Div's St Louis headquarters.

John D Small, from 1950 to 1952 chairman of the US Dept of Defense Munitions Board, has been elected vice president of Pressed Steel Car Co, Inc. Mr Small is also past national administrator of Civilian Production Administration.

T V Picraux has been named production manager of Lincoln Engineering Co's plants. He was formerly sales manager of Lincoln's Industrial Division. Also promoted by Lincoln are **Robert E Redenbaugh** to manager, Original Equipment Div; **Albert J Gruenwald** to sales manager, Industrial Div.

Gene B Spalding, formerly guidance group engineer, has been appointed superintendent of electronics at Temco Aircraft Corp, Dallas, Texas. Also promoted are: **Leon W Mason,** former staff assistant, to assistant superintendent of electronics; **Doyle Beasley,** former general foreman of sheet metal preparation and foundry, to assistant superintendent of all Temco night operations; and **Jack L Crowson,** general foreman, to assistant superintendent of flight ramp and modifications.

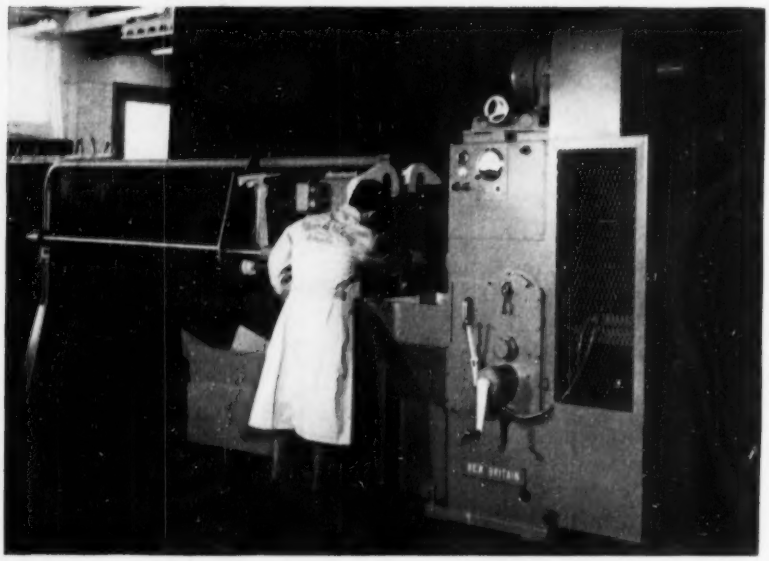
Gale S Humas has been named general manager, **Otto C Turchan** sales manager, and **Demeter Kiurski** chief engineer of Turchan Follower Machine Co, Detroit.

William H Phillips, former assistant to the president of Hein Werner Corp, Kenosha, Wis, has been appointed vice president in charge of production for Hapman-Dutton Co, Kalamazoo, Mich.

Paul D Cornelius now heads Vlier Engineering, Inc's design and research department, Los Angeles. He was previously chief engineer for J O Mfg Co, South Gate, Calif, manufacturers of torque tools.

F J Koegler, since last year president of Doehler-Jarvis Corp, newly acquired by National Lead Co, has been appointed vice-president of National Lead and general manager of its Doehler-Jarvis Division.

New Shop Equipment



New Britain Single Spindle Automatic Designed for Short or Production Runs

Model 126 is a new single-spindle bar machine equipped with a program drum, an automatic transmission with universal turret cam, and standard cross-slide wedge cams actuated by the turret motion.

Said to be suitable in either turret lathe or screw machine departments and on short or production runs, Model 126 is claimed to have the speed required for aluminum and the strength required for high-temperature alloys.

Average time for changing from one setup to another is reported to be 1¾ hours. A universal turret cam provides infinite variation in feed strokes up to 6¾ in. with ten preselected feed rates from 0.003 to 0.060 ipr. Spindle speed is stepless from 80 to 1500 rpm.

The program drum is the nerve center. From this central control station operations of cutting off, unchucking, and stock feeding stroke are governed. Preset strip cams and five limit switches time these movements. The drum is divided into five sections, one for each side of the turret, and bears a scale on each feed section reading directly in inches of turret stroke.

Mounted on the drum are five shifter arms which, during the high-speed cycle, preselect any one of ten feeds for each of the five turret stations. The shifter arms select a gear ratio, without changing cams or gears, that rotates the main turret cam drum at a specific speed to give the desired feed per revolution to the turret.

Cross-slide cams are sine bars or wedges mounted on the front of the turret. With the turret feeds forward, the wedges are moved ahead under the spherical rollers on the ends of the cross-slide arms. As the rollers ride up the cams, the cross slides feed in.

With such a combination of motions, figuring cross-slide feeds is simply a ratio of turret feed to cross-slide feed. Cams are made in four standard ratios: 0.1, 0.2, 0.3, and 0.4. With a turret feed of 0.012 ipr cross-slide feed will be 0.0012 ipr with a 0.1 cam, 0.0024 ipr with a 0.2 cam, etc. For any feed between these standard ratios, the cam angle can be increased or decreased with adjusting screws. A cam-setting gage is supplied with the machine so the operator can preset the cams for the next job at the bench.

This method provides a simple approach to camming. There are no turret cams to change, no cross-slide cams to make, and no feed gears to change. The cross-slide cams are chosen by ratio, the turret feed is obtained from the universal turret cam by changing the shifter arm to give, through the automatic transmission, the desired feed on the turret. The turret feed stroke is varied as desired by locating the brake cam on the program drum.

The New Britain Machine Co, New Britain, Conn

Electrolimit Comparator Provides 110,000 to 1 Magnifications

The universal electrolimit circuit and gage block comparator stand, used in combination with the recently developed P&W electronic recorder, will provide an instrument with 110,000 to 1 magnification.

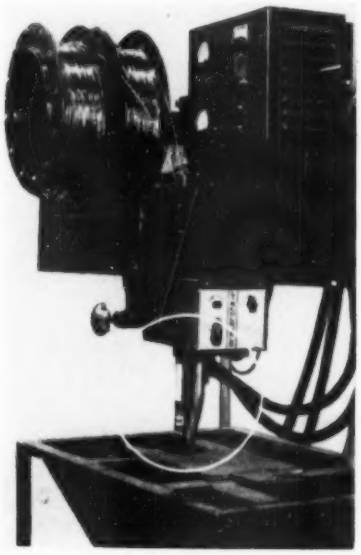
Although primarily designed for checking precision gage blocks to the millionth of an inch, the Electrolimit Millionth comparator has many industrial applications where highest accuracy is required.

The 11-in. scale of the recorder is equal to only 0.0001, with each primary division equal to 0.000005 of an inch, and secondary divisions equal to 0.000001.

Recorder is equipped with a pen lifter and chart drive switch, and is used as an indicating instrument, under normal operation. By using the switch, however, chart carriage is started and the measurements are recorded on paper.

Pratt & Whitney, Div Niles-Bement-Pond Co, West Hartford 1, Conn

Materials and Parts



Lincoln Electric Twinarc Speeds Submerged Welding

Two small electrodes in place of the single larger electrode, known as Twinarc welding, are said to increase speed 50% or more in automatic submerged-arc welding.

The two electrodes are fed simultaneously through a single head and jaw. Both electrodes deposit metal in the weld crater. The higher currents that are possible increase the rate of metal deposition, amount of penetration, and welding speeds obtained.

Twinarc welding is recommended for butt or fillet welds in plate ¼in. thick or heavier where the application is normal for automatic hidden or submerged arc welding. A typical speed is said to be that for a ¾-in. fillet weld—15 ipm at 1500 amp.

A special electrode jaw, wire feed rolls, and wire guides will adapt any standard Lincolnweld head for two electrodes. Currents up to 1500 amp are employed either from two generators in parallel or a single 1500-amp unit.

Electrodes may be 5/64-, 3/32-, and ⅛-in. dia. Current is conducted into both electrodes from the same contact block with the block determining the electrode spacing. Normal spacing is ½ in. Electrodes normally operate in line, but may be skewed for a wider bead. Side by side operation is recommended for poor fit-up.

Twinarc welding is claimed to facilitate welding on rusty or dirty plate. The two arcs and resulting larger crater allow time for gases in the crater to be expelled.

The Lincoln Electric Co, Cleveland 17, Ohio

Burr-Master Chamfers Twenty Ring Gear Teeth per Second

Burr-Master Model BM-2029 deburrs and chamfers all the teeth of a 14-in. dia, 156-tooth flywheel ring gear in only 8 seconds cutting time.

Gear is loaded into the machine by slipping it over three rolls on the fixture, and into mesh with a drive gear. Locating finger, moving with the form cutting tools, automatically locates gear teeth radially on each stroke of the tools, thus compensating for any out-of-round condition or flatness variation.

Generated cutting action enables tools to chamfer and deburr all tooth edges well around the root of the gear tooth, leaving a burr-less chamfered surface. Cutting rate is 20 teeth per second; when cycle is complete, indicator light signals that gear is ready for removal.

The 2300-lb unit occupies 26x34 in. of floor space; working height is 42 in. Powered by a ½-hp, 1800-rpm motor.

Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 4, Mich

... INCLUDING

Lead checker inspects lead and axial pitch for gears to 48-in. diameter. page 206

Electronic adjustable-speed drive has simplified design; speed ranges of 5:1 and 20:1. page 207

Press control valves are designed to stop the press in case of valve failure. page 212

Dynamic balancer introduces a counter motion to balance the work, from this indicates location and magnitude of unbalance. page 216

Tapping attachment for standard drillpress has a rolled thread lead screw to take load off the tap. page 218

Punch press is designed for operations requiring slow strokes. Stub-tooth back gears reduce speed to 40 to 100 spm. page 220

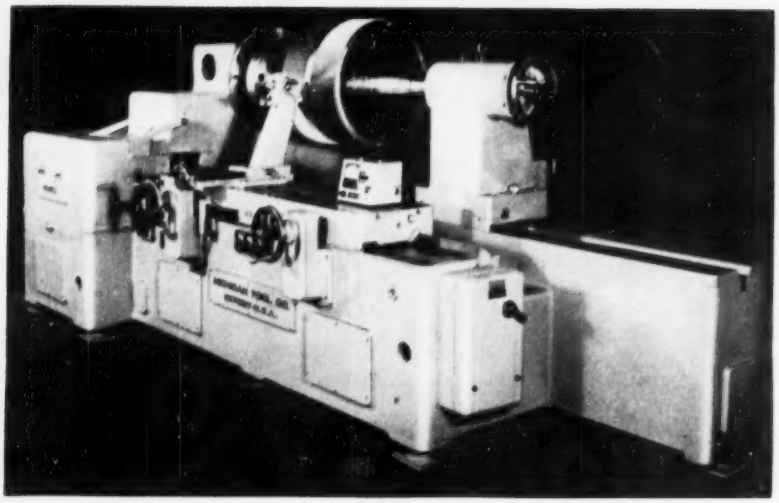
Files are micrometer checked for thickness tolerance. They can be used as hand broaches for precision slot filing. page 226

Auto collimator has a folded optical path to house all parts of inspection instrument within a single casting. page 230

... and in Mar 30

Jig borer in toolroom size for precision boring and milling locates and machines to tenths.

Heavy-duty drilling machine with one to four spindles, has 1½-in. capacity in cast iron.



Michigan Tool Lead Checker Inspects 48-In. Gears

Both lead and axial pitch on large helical or herringbone gears, as well as parallelism of teeth on large spur gears, are checked by the Model 1248 "Sine-Line" lead checker. It will handle gears from 18- to 48-in. OD, with a maximum face width of 25 in. and shaft length of 96 in.

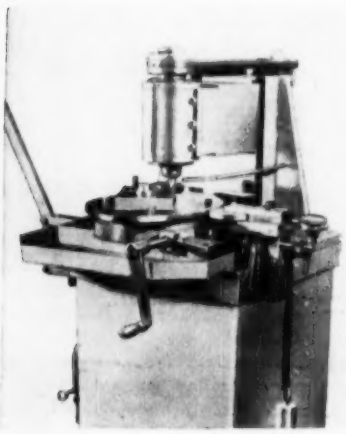
Either right-hand or left-hand leads may be checked. The machine uses the sine bar principle to check leads from 0 to 80 in. Either manual or power drive is used in its operation.

No change in the mounting of the gear is required to check either lead or axial pitch. Gears of varying face width or diameter, but with the same lead, may be checked without changing the setting of the sine bar.

On the heavy cast base provided for rigidity are mounted two tables: a transverse table carrying the sine bar, enclosed in the left of the machine, and a longitudinal table which carries the indicator. The sine bar table is arranged to move crosswise to the machine at the same time the indicator table moves lengthwise, parallel to the axis of the gear being checked.

The sine bar table, when moved back and forth, rotates the spindle upon which the gear is mounted, with the adjustable sine bar determining the relationship between the movement of the indicator table and rotation of the gear being checked.

Michigan Tool Co, 7171 E McNichols Road, Detroit 12, Mich



Cam Profile Mill

Spike profile mill for precision milling of profiles, irregular shapes, hexagons, and geometric forms, reduces eleven conventional milling operations to 2: rough and finish. Machine will hold dimensional relations to a single dimension tolerance.

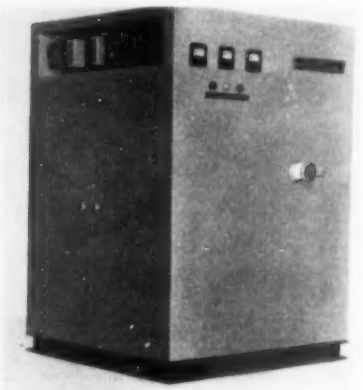
Cams and fixtures are built by the company to specifications. Precision-machined cam is made to a maximum capacity of machine, establishing a ratio-relation to the machined part. Reduces tolerances by the same ratio of cam to part. Can be set up for various jobs by changing cams.

Spike Manufacturing Co, 24609 Middlebelt Rd, Farmington, Mich

Aluminum Oxide Compositions Finish Die-Cast Zinc, Aluminum

A series of aluminum oxide compositions has been developed for the coloring operation in the finishing of zinc-base and aluminum die castings. Laboratory tests and field data are claimed to indicate that they give these castings the desired luster or color faster than previously possible with compositions of the same grade of fineness. They may also be used in finishing steel and stainless steel.

Hanson-Van Winkle-Munning Co, Matawan, NJ



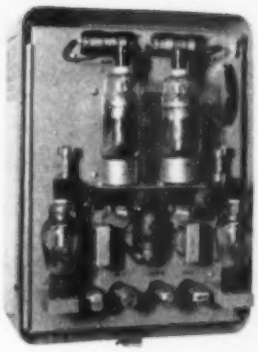
Westinghouse 25-kw Generator For Radio Frequency Heating

A 25-kw radio-frequency generator is available in two models for induction heating. The standard model is for use on relatively long production runs where readjustment will be infrequent—taps on the plate transformer provide power output control. The de-luxe model is for quick setup changes—saturable reactors provide stepless power control. An electronic keying circuit is included on the de-luxe model to permit rapid and precise control of heat cycles.

The unit is rated at 25 kw continuous at 450 kc in accordance with NEMA standards. The tank circuit has a high kva rating, which is the real measure of useful work that can be accomplished.

Both models are said to have the components arranged for easy access for inspection and maintenance. Filament voltage is controlled to ± 30% to prolong tube life. A closed-circuit water-cooling system with a water-to-water heat exchanger employs distilled water. Complete protection is said to be provided against condensation and water impurities with minimum raw water consumption.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa



Simplified Thy-mo-trol Drive

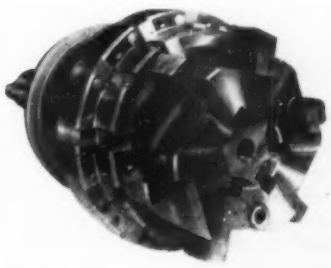
Simplified Thy-mo-trol packaged electronic adjustable-speed drive has been added to the GE line.

Designed for use on many types of equipment, including testing machines, conveyors, variable-volume or proportioning pumps, and machine tools, the unit is available for ¾- to 3-hp drives. Offers stepless and pre-set speed control, and close speed regulation; drive panel measures 15x18x12½ in.

Available in standard speed ranges of 5:1 and 20:1, in reversing and non-reversing forms. Selection of a wide range of speeds is accomplished by turning a single knob. Motor will accelerate to and hold any pre-set speed within plus or minus 3%, regardless of ordinary load changes.

Operates on 220/440 v, single-phase 50/60 cycles. Dual rating of the anode transformer makes it possible to use either voltage by changing primary connections.

General Electric Co, Schenectady 5, NY



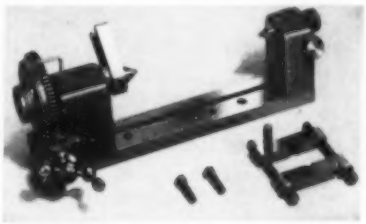
Tap Head Performs 4 Operations With a Single Chucking

The 7-in. ALT tap head has been adapted for performing boring, counterboring, facing, and tapping with one chucking.

Workpiece is bored, counterbored, and faced with the tap chasers collapsed. Upon completion of this operation, tap is withdrawn from the piece, and tap chasers are expanded; thread is then tapped on the surface previously bored.

A leadscrew feed is recommended for both tapping and boring operations to assure long tool life and good finish. Certain design and diameter limitations of the hole to be processed are imposed. Consultation with the manufacturer's engineering department will determine if a specific workpiece is suitable for this special tooling application. Specifications must be included when requesting additional information.

Landis Machine Co, Waynesboro, Pa



Indexing Centers

South Bend Lathe's new indexing centers are designed for small precision work, and can take stock up to 5 in. in dia and 6 in. in length.

Particularly suitable for dividing operations, such as machining splines, flutes, and gears, it is also useful for milling, shaping, and grinding squares, hexagons, or odd angles. Accurate cross-drilling can be held to close tolerances with the centers.

Ball crank and worm gear turn the head center. Each graduation indicates a center movement of 3 minutes; complete turn of the crank revolves center 5°. For quick positioning, worm gear can be disengaged and a clamping device locks head center in any desired position.

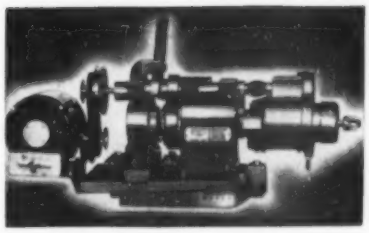
South Bend Lathe, South Bend 22, Ind

Aluminum Bronze Wear Strips

OK wear strips in welded Amco bronze are produced by a special method of bi-metal welding, reducing the amount of bronze needed.

Wearing surface is aluminum bronze, welded to a soft steel base, readily machinable for required drilling, tapping, and machining to required thickness. Surfaces are ground to close tolerance, reducing manufacturing and assembly time. Large assortment of sizes available, or made to special order.

The Ohio Knife Co, Dreman Ave, Cincinnati 23, Ohio



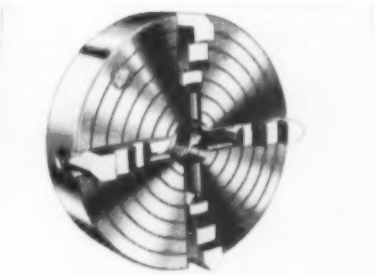
Circularity Grinding Device

Motor-driven Model 500 circularity grinding attachment simultaneously revolves the work to be ground and moves it longitudinally back and forth. This operation is the result of direct gear drive from drive shaft to collet housing gear and spacer gear.

Standard spacer gears with a follower pin for each flute to be ground provide indexing for 2, 3, 4, 6, 8, or 12 flutes. Special spacer gears can be provided when number of flutes are other than those listed. Number of back and forth movements per revolution of work is controlled by number of follower pins used in spacer gear.

Setups on the attachment permit grinding of form relief, radial relief, form and radial together, tapered, and straight cylindrical. Tool is held in collet or between dead centers and revolves on its own axial center.

Detroit Reamer & Tool Co, 2830 E Seven Mile Rd, Detroit, Mich



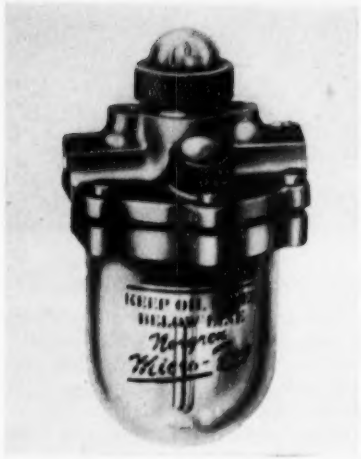
Chuck for Direct Mounting

No. 5909 is an 8-in., 4-jaw independent chuck, threaded 2¼ in.-8 for direct mounting lathes, milling machines, grinders, and other tools with applicable spindles.

No adapter is required; chuck is mounted close to spindle bearing to minimize chatter caused by excessive overhang.

Unit weighs 19 lb, has a body thickness of 2⅛ in., center hole diameter, 1 9/16 in.

Westcott Chuck Co, Oneida, NY



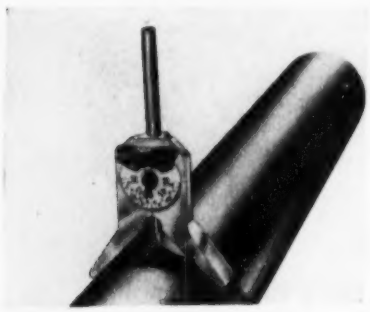
Norgren Micro-Fog Lubricator

Micro-Fog lubricator for bearings, spindles, gear boxes, and small air-powered devices is specially designed to produce an extremely fine and uniform oil fog at low air flow.

Unit has constant oil level to assure a uniform rate of oil feed, 360° visibility of oil flow, accurate metering of delivery into the airline to as little as 1 drop in 20 minutes by means of air control, and universal right to left or left to right flow without adjustment. It cools as it lubricates high speed rotating parts.

Designed for ¼-in. airlines; rated air requirements from 0.8 cfm at 10 psi to 6 cfm at 80 psi. Maximum safe operating pressure, 150 psi; maximum safe temperature, 120 F.

C A Norgren Co, Englewood, Col

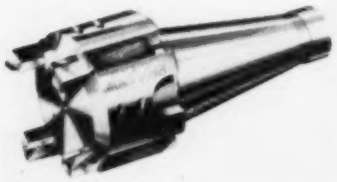


Boyce Centering Head Can Replace Five Tools

Boyce centering head is said to do the work of a protractor, centerhead, center punch, level and scale. The 9-oz device can be used to measure or establish the degree of any angle, or of the bend on the outside or inside of any circumference; it will measure the degree of declivity of any flat surface, and mark a point at any degree from center on pipe or other round objects.

Two-pronged aluminum body has a 1¾-in. protractor dial fitted with an accurate level. Dial is graduated in 2½° and marked in 10° for easy reading. Marking punch is a ⅜-in. drill rod with hardened point.

Contour Marker Corp, 1843 E Compton Blvd, Compton, Calif

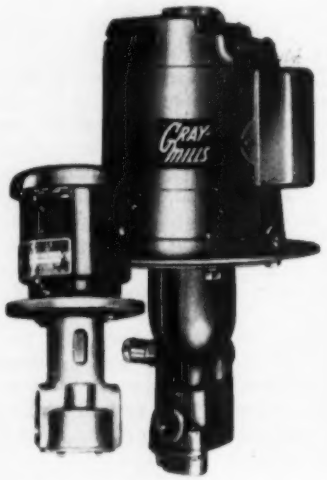


Universal Fly Cutters

Universal fly cutters are available with blades ground on both locating sides to assure an absolute minimum of total indicator runout when tool is in operation.

Sizes range from 3 to 6 in., and may be had in 4 and 6 blade styles.

Wendt-Sonis Co, Hannibal, Mo

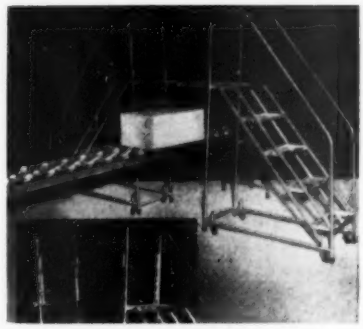


Small Gear Pump

Line of gear pumps has been introduced in three basic sizes for fluid delivery: 1, 2, and 3 gpm. Motor sizes are 1/25, ¼, ⅛, and ½ hp, with pressures to 100 psi; designed for coolants, oils, solvents, machine tools, circulating systems, etc.

Units are self-priming, directly connected to face-mounted motors; relief valves, inlet filter, and various mounting flanges are optional. Can be mounted vertically, either immersed in shallow tanks or with inlet piped dropped to the liquid.

Graymills Corp, Chicago, Ill

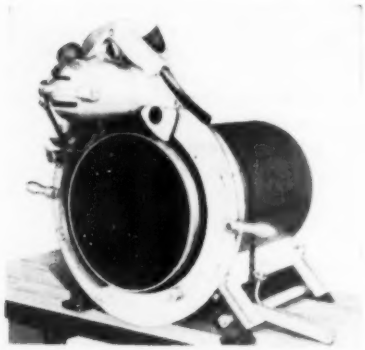


Step Ladders Equipped With Connecting Walkway

Dual safety step ladders equipped with a connecting walkway are designed to eliminate passage blocks and inaccessibilities of areas above conveyor systems. Walkway can be folded up, and ladders used for normal requirements when not needed to cross over conveyors.

Standard size ladders are available for any required height. Two types of the steel ladders are supplied—one with rubber-tipped legs only, for permanent or semi-permanent installation, the other has casters for easy movement. Casters automatically retract when ladder is mounted so that rubber-tipped legs engage the floor.

Ballymore Co, Wayne, Pa



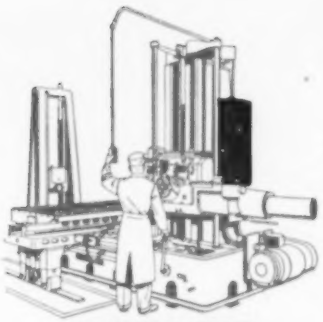
Tri-Clover Power Cutoff Saws

Two new portable models of the Super Speed power cutoff saw are available; one cuts from ½-in. tubing through 6-in. pipe, the other from ½ in. through 12 in.

Abrasive wheels cut pipe and tubing of aluminum, copper, stainless, and other metals, in varying wall thickness, producing a square, nondistorted surface without misalignment or burrs.

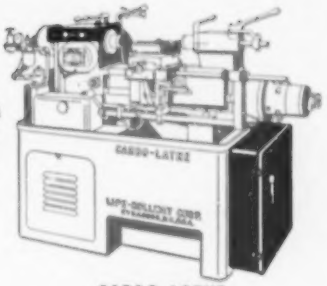
Saw uses 110-v ac; it is attached to the frame so that both rotate together.

Tri-Clover Machine Co, Kenosha, Wis

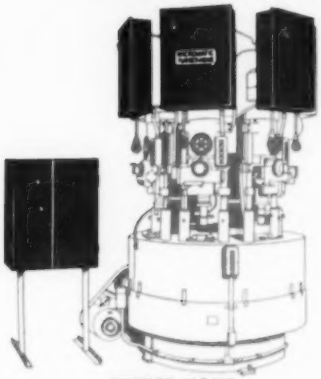


HORIZONTAL BORER

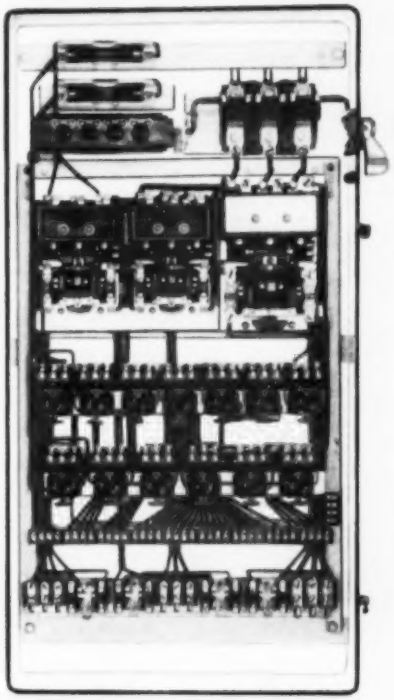
DRILLING MACHINE



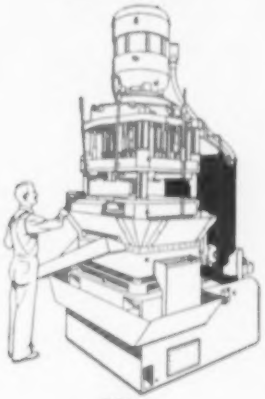
CARBO LATHE



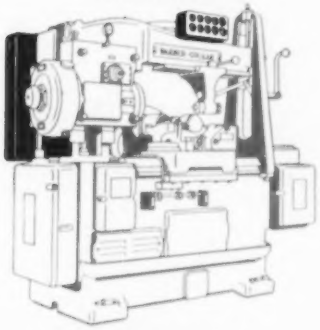
TURRET-HONE



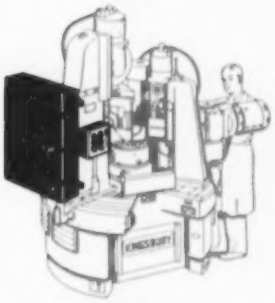
Typical machine tool control panel showing disconnect unit, contactors, and accessories



DRILL



HOBBING MACHINE



TAPPING MACHINE

MACHINE TOOL CONTROL PANELS

• • • ENGINEERED TO SATISFY YOUR NEEDS

Allen-Bradley control panels are popular with machine tool builders, because—

1—A-B contactors and relays have acquired a world-wide reputation for dependability and precision control. Consistently, they perform millions of trouble free switching operations.

2—A-B engineers, through long experience, are skilled in developing sequence control panels. Due to the compact design of A-B components, smaller panels are a common result . . . which means less space is used on the machines.

3—The A-B trademark is a sales asset for your motorized machine tools. It is the mark of Quality in motor control . . . known and accepted by machinery buyers, everywhere.

It will pay you to discuss your control problems with Allen-Bradley. A field force of Allen-Bradley engineers, located in all principal cities, is at your service. We shall be glad to send you the A-B Handy Catalog.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

4-53-R

A-B Quality

ALLEN-BRADLEY QUALITY

SPECIAL PANELS

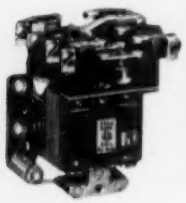
A-C & D-C TROUBLE FREE RELAYS

from 1 to 12 POLES

THE UTMOST IN RELAY DEPENDABILITY

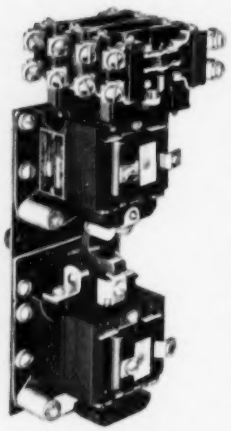
HUM-FREE A-C RELAYS

Relays in hospitals, churches, etc., must be hum-free. For these places, Types BM and BXL relays are recommended. Continuous coil currents are not needed to hold them closed. Also useful for machine tools.



TYPE BM—Residual Magnetic Latch

Contacts are held closed by residual magnetism of core. A demagnetizing coil current opens relay.



TYPE BXL—Mechanical Latch 2-Unit Relay

Lower solenoid trips the mechanical latch of the upper relay to open the upper relay contacts.

Bulletin 700 Relays are built to the same critical operating standards as the larger switching units in the Allen-Bradley line.

They have only one moving part . . . the simple solenoid plunger that opens and closes the double break, silver alloy contacts. Available in many varieties of contact arrangements . . . up to 12 poles . . . with or without enclosures. Long, trouble free life makes these relays the ideal pilot controls for installations which are likely to get infrequent inspection and maintenance.

Send for Bulletin 700 containing complete details on ratings, dimensions, and related accessories.

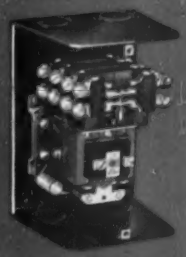
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

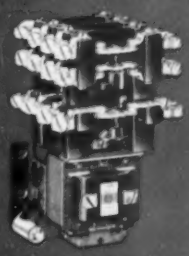
RELAYS & CONTACTORS

A-B Quality

TYPICAL RELAYS in the ALLEN-BRADLEY LINE



Relay in Enclosure

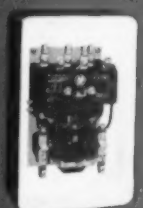


8 Pole A-C Relay

2-Wire Thermostat Relay

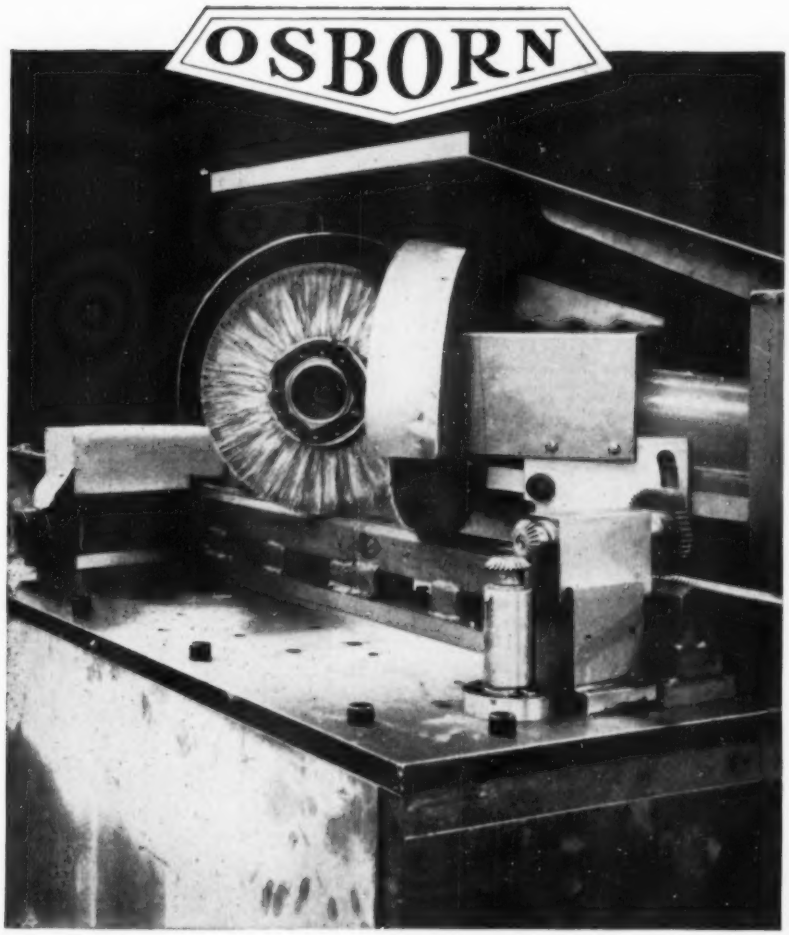
Low Current A-C Relay

D-C Relay



Bulletin 709 Size 3 Solenoid Contactor

4-53.8



Formerly 50 minutes...
Now brush-deburred in 6 minutes

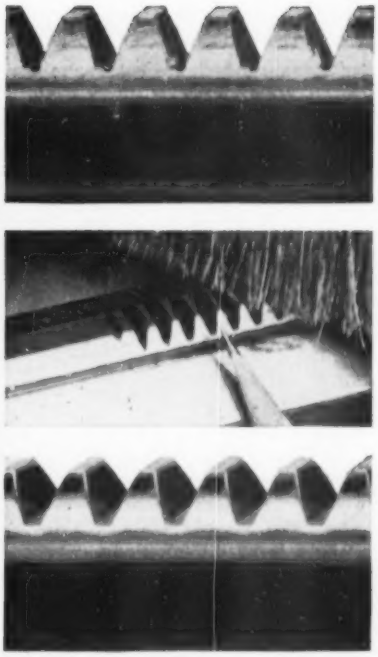
8 times as fast... more uniform deburring... finer surface finish. These are the advantages gained by a large machinery manufacturer with an automatic power-brushing method. The part: a rack gear, 17 ft. long with more than 1000 teeth. The job: light deburring of machine-cut teeth, and blending the junctures of intersecting surfaces to form smooth curves in place of fragile, sharp edges.

With the help of their **O**sborn **B**rushing **A**nalyst, they devised the machine shown above. This automatically controlled machine with two heads of Osborn Fascut® brushes does the entire job in 6 minutes. Burr removal and surface juncture blend are far superior to former methods.

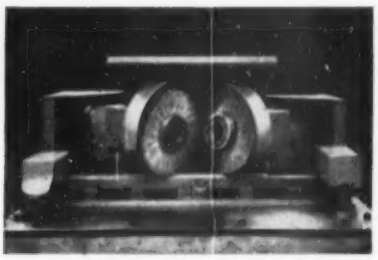
This is typical of thousands of cases where production is being vastly improved with Osborn power brushing methods. Find out how you can cut *your* costs! Call in your **OBA** today or write *The Osborn Manufacturing Company, Dept. C-3, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES

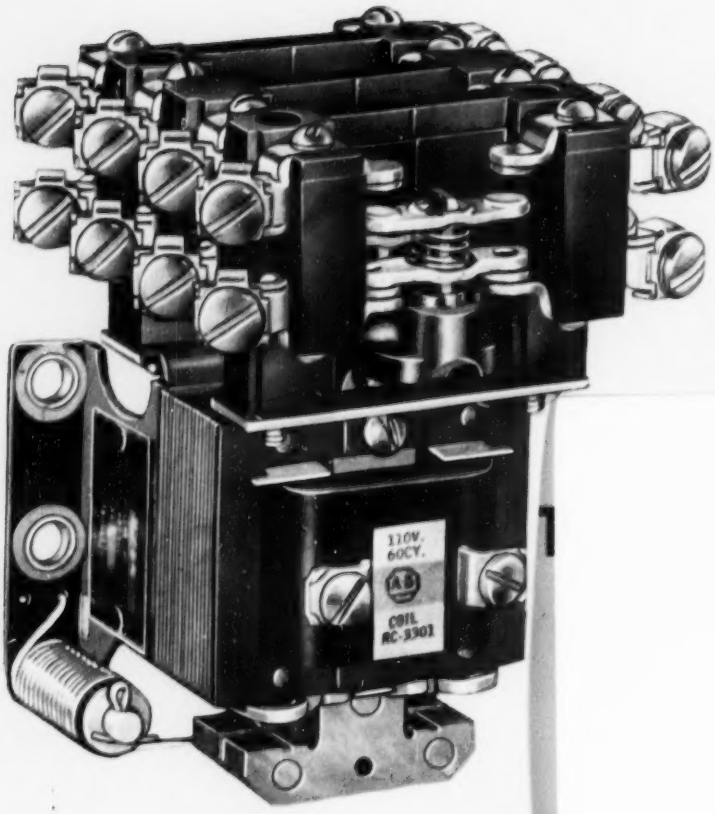


BEFORE AND AFTER. Top view shows closeup of rack teeth with light burrs and rough surface before brushing by new "push-button" method. Center view shows closeup of rack in machine after completion of brushing. Bottom view shows teeth after brushing. Note uniform surfaces and smooth finish on all teeth.



HOW IT'S DONE. Two rotating Osborn power brushes, engage rack teeth at angles as shown. At push of button, rack drives through machine at about 5 ft. per minute. When the rack completes passage, the drive reverses and sends it back in the other direction. On return travel of part, the direction of brush rotation is reversed to contact surfaces on the opposite side of rack. This gives both sides of teeth uniform brushing.

WHAT'S YOUR PROBLEM? The nearby Osborn Brushing Analyst is experienced in working with machine designers and methods engineers to solve problems with the latest power brushing techniques. Feel free to call him for help!



THE UTMOST IN RELAY D

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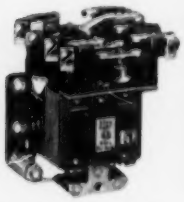

TYPE BM—Residual Magnetic Latch

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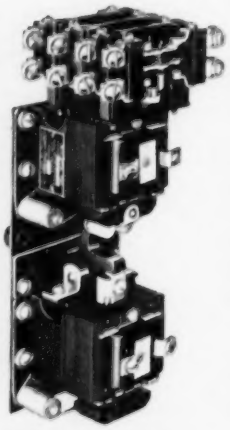

TYPE BXL—Mechanical Latch 2-Unit Relay

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Send for Bulletin 700 containing complete details on ratings, dimensions, and related accessories.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

RELAYS & CONTACTORS

A-B Quality

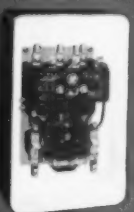
TYPICAL RELAYS in the ALLEN-BRADLEY LINE

PAC

MISS

Low Current A-C Relay

D-C Relay



Bulletin 709 Size 3 Solenoid Contactor

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inutes

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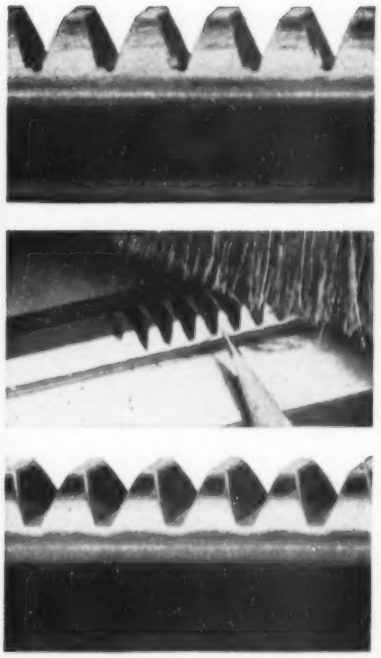
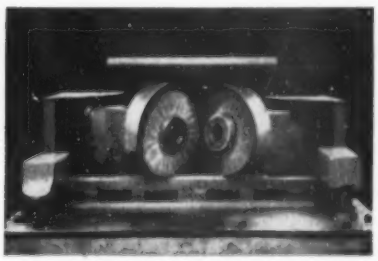
This is typical of thousands of cases where production is being vastly improved with Osborn power brushing methods. Find out how you can cut *your* costs! Call in your **OBA** today or write *The Osborn Manufacturing Company, Dept. C-3, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES

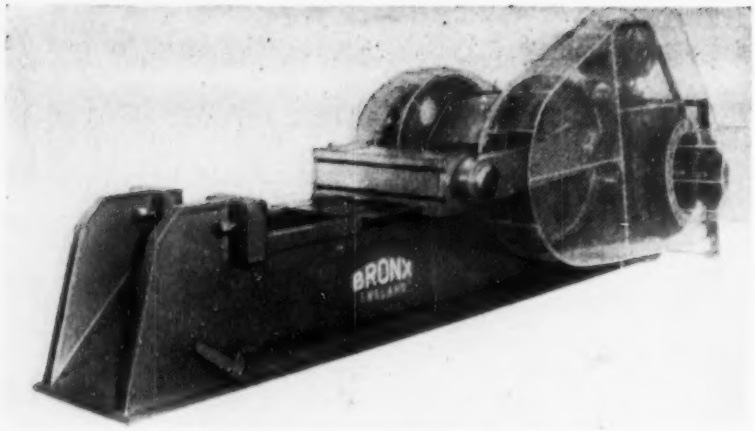


BEFORE AND AFTER. Top view shows closeup of rack teeth with light burrs and rough surface before brushing by new "push-button" method. Center view shows closeup of rack in machine after completion of brushing. Bottom view shows teeth after brushing. Note uniform surfaces and smooth finish on all teeth.



HOW IT'S DONE. Two rotating Osborn power brushes, engage rack teeth at angles as shown. At push of button, rack drives through machine at about 5 ft. per minute. When the rack completes passage, the drive reverses and sends it back in the other direction. On return travel of part, the direction of brush rotation is reversed to contact surfaces on the opposite side of rack. This gives both sides of teeth uniform brushing.

WHAT'S YOUR PROBLEM? The nearby Osborn Brushing Analyst is experienced in working with machine designers and methods engineers to solve problems with the latest power brushing techniques. Feel free to call him for help!



100-Ton Bulldozer Has 10-in. Stroke

Series B100 bulldozer built by Bronx Engineering of Stourbridge, England, is designed for forming and bending heated stock. However, the bed is said to be rigid enough to permit cold forming to the capacity of the machine.

Different tools may be set up on top of one another so that successive operations may be done in the same heat. Upsetting, punching, and shearing are possible with a few changes in tooling.

The bulldozer is driven by an adjustable friction clutch drive designed to slip before damage occurs to the machine if overloaded. The brake and clutch are interconnected to permit inching.

The 100-ton machine has a 10-in. stroke with a speed of 15 strokes per minute. The face of the crosshead is 10x36 in. Drive is 10 hp.

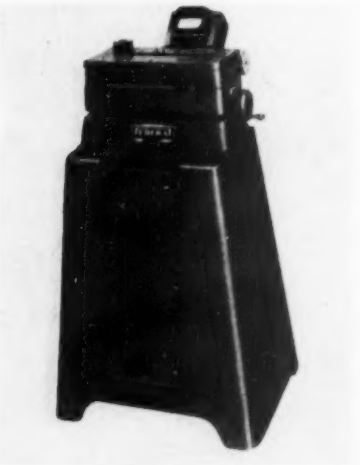
Imported by International Machinery Div, British Industries Corp, 16½ Duane St, New York 13, NY

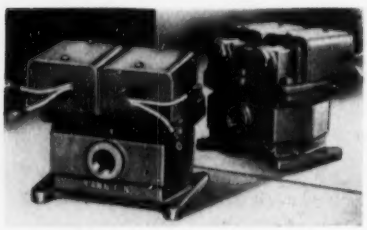
Low-Temperature Test Units

XV-70 Series industrial chilling machines, in sizes from 1.5 to 5 cu ft, will hold any temperature from –10 to –70 F with a thermal capacity of 500 Btu per hr.

The units are designed primarily for test purposes and are said to be unusually compact for their chilling chamber capacity. The inside is lined with 3/16 in. steel for protection against heavy or sharp edged metal parts.

Sub-Zero Products Co, 3930 Reading Road, Cincinnati 29, Ohio





Hannifin Air Control Valves For Presses "Fail Safe"

A special air control valve for mechanical presses controlled by air-operated clutches and brakes is said to make repeat strokes from valve failure practically impossible. A dual 3-way valve, it includes two 3-way valves in parallel in one common body. Both valves must operate to start the press, but if for any reason only one valve reverses, the unit "fails safe" and the press stops.

Called the P-M Series BB-5, the valve is furnished only in ¾-in. ips. The valve is capable of speeds in excess of 600 cycles per minute and cannot fail other than safe unless both pilot sections or both main valves develop identical failures on the same stroke of the press.

Two solenoids in the valve are connected in parallel in the electric circuit of the press. The two pilot sections are interlocked pneumatically so that, if either solenoid fails to operate, the valve will not build up enough pressure to operate either main valve and the press will not start.

With the press moving, if either solenoid or either pilot valve reverses, pilot pressure will fall so low on both sides that both main valves will reverse and the press will stop. If one of the main valves sticks in the "on" position, both exhaust ports carry away not only the incoming air through the stuck valve, but the air in the press clutch and brake mechanism, stopping the press.

In normal operation, both main valves operate simultaneously. Their combined capacity gives the valve on actual flow tests more than half again the air capacity of a single full flow valve of ¾-in. ips.

Hannifin Corp, 1118 S Kilbourn Ave, Chicago 24, Ill

Master Comparator Applies Constant Pressure to Work

Constant pressure is applied to the sides of the work by each contact at every point of measurement in a new electronic comparator. An operator observing the proper precautions, such as constant temperature, cleanliness, and correct operating procedure, is said to be able to obtain repeat readings and detect dimensional variations to plus or minus one millionth of an inch.

The operator has a selection of four magnifications: 500 to 1, 1500 to 1, 5000 to 1, and 15,000 to 1, all on the same meter.

Overtravel is provided in the measuring unit to prevent damage or loss of calibration.

Capacity ranges for each set of contacts for inside measurement are: 0.125 to 0.240, 0.240 to 0.365, 0.365 to 0.825, and 0.825 to 10.000 in. For outside measurements the range is from 0.000 to 9.000 in. Gaging pressure is 8 oz for either inside or outside use.

Federal Products Corp, 1144 Eddy St, Providence 1, RI

DON'T LET OBSOLETE EQUIPMENT PUT YOU OUT OF COMPETITION

Old-fashioned, out-of-date and outworn equipment has no place in any modern industrial plant . . . and certainly plays havoc with your chances of competing successfully.

SIDNEY *FLUID TRACER* LATHES

THE "LAST WORD" IN COST-SAVING EFFICIENCY

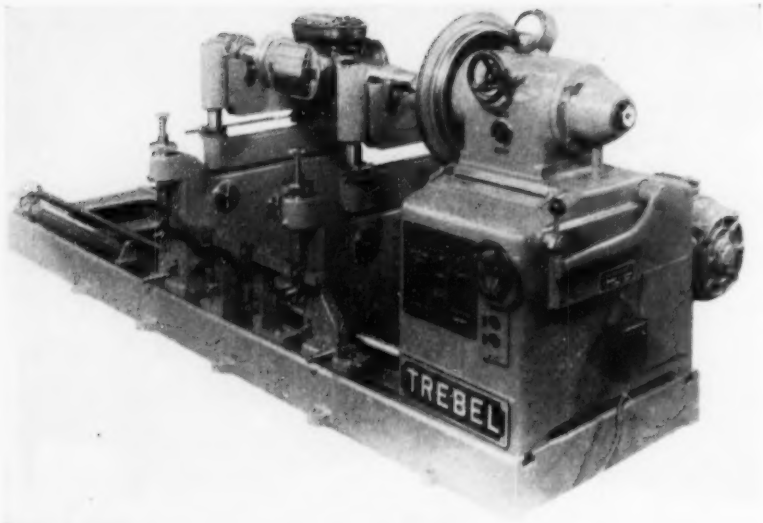
You save amazingly on production-time per piece — in large or small quantities. You save on maintenance. Result: your costs are reduced so that you can compete . . . and GET THE ORDERS!

The sensitive tracer head transfers every change in contour from the master piece or template to the cutting tool regardless of size, shape or quantity. Change-over to standard lathe operation or back to tracer requires only a few SECONDS since no addition or removal of extra parts is necessary.

WRITE FOR BULLETINS

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



Trebel Dynamic Balancer Introduces Counter Motion to Balance

By measuring the counter motion which must be introduced into the bearings in which work rotates to provide smooth running, the Trebel Dynamic Balancing machine indicates the location and magnitude of unbalance in ounce-inches. For more specialized work, unbalance can be indicated as the number of holes to be drilled or slugs to be added.

The machine consists of a bed, headstock, drive motor, and two independently movable supports. These supports carry open-bearing rollers on which the work is rotated. Half shoes for babbitt bearings or V-type holders for ball bearings may be provided. Height of the brackets is adjustable to suit work diameter.

An electronic amplifier in the headstock includes a filtering unit and rectifer to show unbalance vibrations. Plane selectors are placed underneath the previously determined planes of compensation of the work. At these selectors a cam introduces the counter-vibration which is transmitted through a spring to the nodal bar and then to the bearing supports.

Two handwheels, one for angle, the other for magnitude, control the counter force which is introduced into the bearings on which the work rotates. By turning the wheels the counter force is varied to neutralize the force of unbalance. Location of this counter force can then be read in degrees while the amount is read in ounce-inches or other units.

Imported by Kurt Orban Inc, 205 E 42nd St, New York 17, NY

Measuring Instrument Checks Internal and External Threads

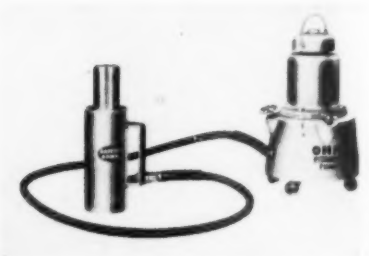
Universal lead measuring instrument is designed to determine the lead of internal and external threads of work up to 8-in. dia and 18-in. length.

The base supports a fixed headstock at the right end which, besides mounting the centers, carries the barrel of a specially constructed micrometer. The tailstock can be used in either of two runways for work of various diameters.

The longitudinal carriage runs on balls on hardened and ground ways and supports the totally enclosed micrometer nut. On this another carriage supports the amplifying and indicating unit which can be traversed longitudinally and locked in desired position. Magnification is 400 to 1.

The stylus holder can be rotated to suit various setups and a spring-loading device permits suitable pressure between the stylus and the work. The 40 tpi micrometer screw has a working travel of 2 in. Small residual lead errors are corrected by a compensating attachment. An attachment is available for measuring taper threads.

The Sheffield Corp, Dayton 1, Ohio



Ohio Pump and Safety Ram

Air-operated hydraulic pumps operate from shop airline connection. Hydraulic pressure is provided from 0 to 12,000 psi. The pumps are intended for continuous service at maximum capacity without overheating. Weighing 35 lb, the pumps can be adapted to any hydraulic installations and to manual-operated arbor presses.

A safety ram designed for use with the pumps is available in 20-, 35- and 70-ton capacities. The ram unloads itself automatically to prevent any possibility of plunger popout.

Powermatic, Inc, 1944 E Market St, Akron 5, Ohio

Molykote in Volatile Solvent

Molykote M-88 is a dispersion of near-colloidal particles of Molykote powder combined with an ortanic binder in a volatile solvent. It can be applied to clean surfaces by spraying, brushing, or dipping. The solvent will evaporate leaving a coating of Molykote ranging from 0.0002 to 0.0007 in. in thickness.

Maximum uniformity and minimum thickness of coating are obtained by spraying parts heated to 300 F. M-88 is intended for use where a heavier and longer-lasting dry lubricating film is desired than can be obtained with Type Z powder.

The Alpha Corp, 179 Hamilton Ave, Greenwich, Conn

"No doubt about it... Sinclair saves us money"

... says W. P. St. John, Owner, Radax Manufacturing Co., Rochelle Park, N. J.

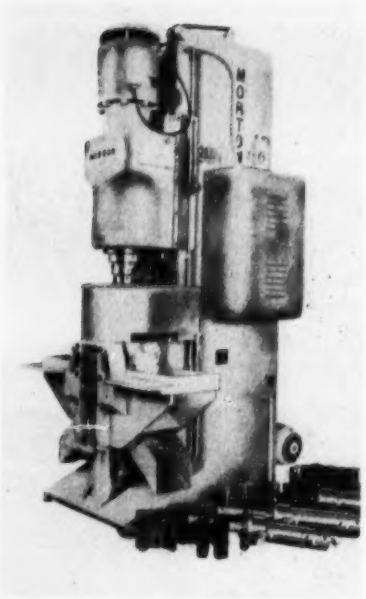
Sinclair UMBRA making a tough job easier — gear cutting S.A.E. 4340 steel—45 Rockwell

The Radax Manufacturing Company has a reputation for tackling "tough jobs." As Mr. St. John says, "Our extensive equipment allows us to contract for extreme precision work – work that requires the very finest of cutting oils. We've been using Sinclair RIVALO®, UMBRA® and EMULSICOOL® exclusively for four years. They've enabled us to increase our production, produce better finishes and greatly reduce downtime for tool sharpening. As a result, our unit costs are less. There's no doubt Sinclair cutting oils are saving us money."

Sinclair cutting oils can help save money for you, too. Why not phone or write the nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR CUTTING OILS and COOLANTS

...for Metal Working



Morton Boring and Finishing Machine for Car Journal Brasses

Vertical boring and finishing machine is designed for performing both the rough-boring operation before babbitting and the finish-boring operation after babbitting of AAR Car Journal Brasses. The machine is semi-automatic in operation.

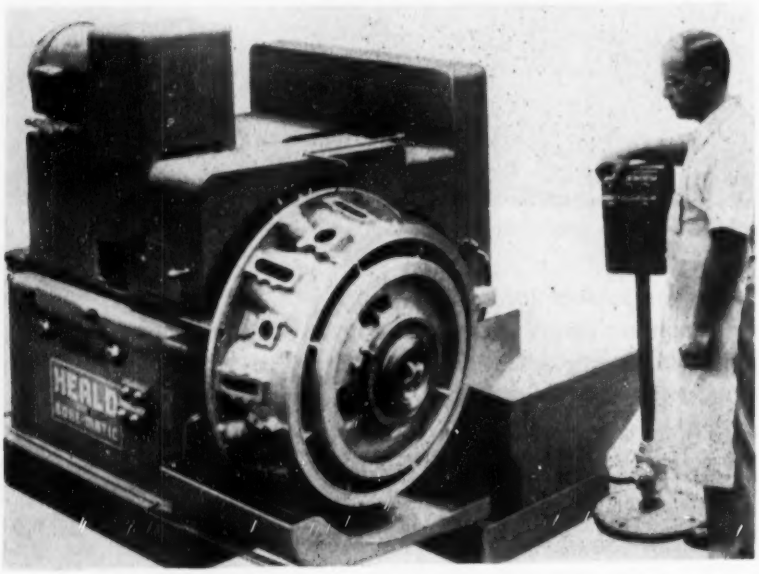
Two bearings are placed in the centering figure with the machine in the loading position. Upon pressing the start button the hydraulic clamp cylinder moves the carrier arms to the vertical clamping position. At the completion of this cycle the cylinder retracts, the saddle raises to clear the large fillet-facing cutter, and the bearing carriers start to open simultaneously with the return to the stop position.

A 15-hp, 90-rpm vertical motor drives the spindle through the gear box. Sliding reduction gears are provided for adjusting spindle speeds for rough boring and finishing operations. Power for operation of clamping and for feeding the cutters is from a self-contained hydraulic circuit driven with a 5-hp motor and control equipment.

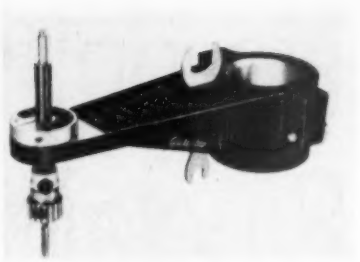
Morton Mfg Co, Muskegon Heights, Mich

Cycloflex Spec No. 7731 is a plastisol product which, with heat, is converted into a flexible rubber-like coating for metal parts. Resistant to oils, acids, and oxidation, and will not harden on aging. Can be furnished from 1/32 to ½ in. thick.

Munray Products, Inc, 12400 Crossburn Ave, Cleveland 11, Ohio



PRECISION BORING MACHINE, No. 331 Bore-Matic, is a No. 3 way-type unit with a vertical indexing 8-station fixture. The low mounting position of the fixture on the way unit facilitates handling the heavy jet engine part. Forty individual borizing operations are performed on each part with a total cycle time, including loading and unloading, of 12 min. per part. Table is interlocked with crossfeed units so that it will not start the out-stroke until all tools on crossfeed are clear of work. Table is also interlocked with fixture so that cycle cannot be started until part is properly indexed— *The Heald Machine Co, Worcester 6, Mass*



Leadscrew Tapping Attachment

A tapping attachment for use in a standard drill press that will take the tapping load off the tap has a rolled thread lead screw and adjustable split nut in which it works to carry the driving load. The auto-tap has a cast aluminum arm for attachment to the drillpress. Leadscrews and split nuts can be changed for different pitches with two small wrenches.

Automatic Methods, Inc, Div 16, 42 Walnut St, Newark 2, NJ

Winter Controlled-Power Press

Improvements in the Model RR-7 controlled-power safety press are said to provide increased impact, cleaner design, and mechanical simplifications. A bench-type air-and-spring-powered press, it is for light staking, assembly, and marking operations.

Impact can be adjusted from 0 to 12,000 lb and squeeze can be up to 12 times airline pressure. Either pedal release or two-hand safety release can be used. Model 300 slide feed and small-parts tray will fit this press.

Winter Products, Inc, Box 5112, Barnum Station, Bridgeport 5, Conn

Collaborate with Revere for Reliability ...as in RAYDAC

This is the RAYDAC. It has 15 panels totaling 44 feet in length. It uses the latest techniques in sub-miniaturization.

View behind the scenes, showing Raytheon engineers testing the RAYDAC circuits with oscilloscopes.

RAYDAC means Raytheon Digital Automatic Computer, developed by the Raytheon Manufacturing Company, Waltham, Mass., for the Navy's Bureau of Aeronautics. It is an "intelligence center" to help analyze the behavior of missiles during test flights. Its importance is indicated by the fact that in a matter of minutes it can perform the calculations involved in analyzing a single missile flight, a task that would take a team of mathematicians from 20 to 30 days. The Raydac thus speeds up tremendously the development and testing of such missiles. It contains enough tubes and germanium diodes made by Raytheon, for more than 1,000 home radio sets.

In such a complicated electronic computer reliability is essential. This is achieved through design, the choice of the best materials and components, and meticulous manufacture. Revere during the past 10 years has collaborated closely with Raytheon, working out proper specifications for materials, as for example, OFHC copper. Raytheon engineers and production men have visited Revere laboratories at New Bedford, Mass., and Rome, N. Y., and many Revere specialists have studied methods and processes in the Raytheon plants and laboratories. These hand-in-glove contacts, many of them highly confidential, have proved their value.

The same kind of collaboration is open to you, and will be especially useful and time-saving if begun as soon as you have a new project on your boards. To obtain it, simply get in touch with the nearest Revere Sales Office. See your telephone book or write direct.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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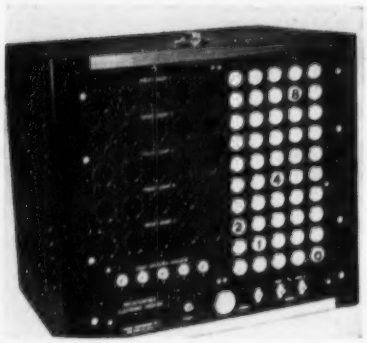
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY



Electronic Counter Uses Cold Cathodes

Long dependable life and high accuracy because of all-cold-cathode-tube design is claimed for a new line (model GW) of counters for industrial application. They allow easy reading from a large dial without interpolation. No warmup period is required because the tubes do not operate with filament current.

Single, dual, or multiple sequencing is available. Tube-life expectancy is ten years. Top speed of counting is 15,000 per minute. A control relay is available to perform a given function after a predetermined number of counts have been made. Resetting is automatic.

Haledy Electronics Co, 57 William St, New York 5, NY

Slow-Running Coolant Pump

MECO Model 662 self-priming centrifugal pump is particularly adapted to coolant fluids, cutting oils, etc. Discharge port may be restricted by means of valves or nozzles without loss of horsepower or strain.

Unit is adaptable to multiple-nozzle hook-up; limiting factor is the total distributed volume. It is said to be particularly useful for drill-press operations where more than one spindle is used.

Pump can be fastened to the outside of a tank, or directly to the coolant sump of a machine tool. Discharge port may be placed in one of four different positions, while mounted, if desired.

Motor is 1/6 hp, 115 v, 60 c, single phase, 1725 rpm, starter type, with overload re-set switch. Unit is priced at $86.65.

Mechanical Engineering Co, 608 S Dearborn St, Chicago 5, Ill

Rotary Pressure Joint

ANCO rotary joint conveys steam under pressures up to 350 psi and liquids to 3500 psi while rotating at high speeds. Equipped with a self-adjusting wear take-up, units have single or double race ball bearings.

Self-lubricating rotary seal and its mating part are so designed that efficiency of the sealing members cannot be affected by any misalignment or eccentricity up to 10°. Auxiliary seal prevents any loss of grease or condensate past the bearing. Withstands temperatures from −100 to +600 F.

Self-supporting joint is available in all pipe sizes from ¼ to 5 in. inclusive, supplied to withstand chemical reactions of materials to be handled.

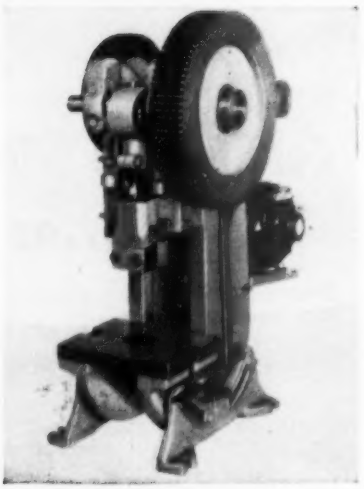
ANCO, Inc, 1 Baker St, Providence, RI

Universal Gage Handle

A Universal handle for reversible go and no-go plain and thread plug gages is available. Each gage member is supplied with an aluminum bushing, permitting multiple combinations of sizes to be made up.

Eight handles will accommodate a range of plugs from 0.010 to 0.750 in. dia. Handle is made of anodized aluminum; plug members can be adjusted to required length to minimize breakage.

Size Control Co, 2500 W Washington Blvd, Chicago 12, Ill



Back-Geared Punch Press

Benchmaster punch presses, equipped with stub-tooth back gears, reduce speed range from 40 to 100 spm; speed may be varied by changing size of motor drive-pulley. They are especially designed for drawing, forming, and other metal operations requiring slow, powerful strokes.

Positive, single-trip mechanism is employed requiring ram to be individually triggered for each stroke; stroke can be easily converted to continuous motion by removal of one screw. Unit can be either hand or automatically fed with a variety of automatic friction roll feed.

Three presses are available with back-gearing: the 4-ton standard, 4-ton deep throat, and the 7½-ton models. Shut heights and general specifications are identical with respective plain types.

Benchmaster Manufacturing Co, 1835 W Rosecrans Ave, Gardena, Calif

Foot-Operated Toggle Switch

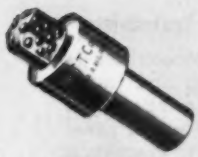
Model FPC foot power control, reversing foot-operated toggle switch, is made up of an Allen-Bradley Bulletin 350 size 00 drum switch encased in a dust- and oil-tight steel enclosure.

Developed for welding positioner control, switches may be hand-manipulated as well as foot-operated.

Aronson Machine Co, Arcade, NY

RADIUS FORMING TOOLS

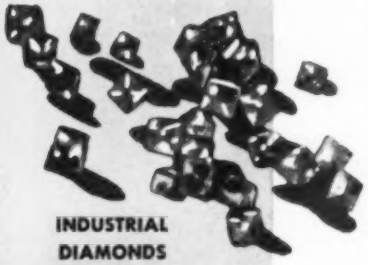
"TRU-LINE" PROFILE DRESSING TOOLS



IMPREGNATED DRESSING TOOLS

STANDARD DRESSING TOOLS

"TRU-THREAD" THREAD DRESSING TOOLS



INDUSTRIAL DIAMONDS

MULTI-DIAMOND TOOLS

"Sell it and make your fortune Mynheer Van Niekirk"

It was the year 1876. Free America was 100 years old and there were great celebrations in Philadelphia. In London, Queen Victoria was proclaimed Empress of India.

In South Africa, children playing by the Orange River found a bright pebble, too pretty to throw away, but when trader Van Niekirk offered to buy it they shouted with laughter and told him to sell it and make his fortune.

But, nobody wanted to buy the pebble so Van Niekirk dropped it in an envelope and mailed it to a government agent who declared it to be a diamond of 21 carats. Then, the governor of the Colony bought it for five hundred pounds and sent it to the Paris Exhibition as a curiosity.

Nobody paid much attention, but this was the first clue to the existence of the diamond fields that would one day pour out fabulous treasures in gems—and in industrial diamonds, those incomparable cutting points which do so much to increase production and reduce costs.

The diamond fields are but 75 years old, and for 43 of those years we have specialized in importing and selling industrial diamonds and manufacturing industrial diamond tools—engineered to your job and guaranteed to do it. Please write for our catalogs.

WHEEL TRUEING TOOL COMPANY

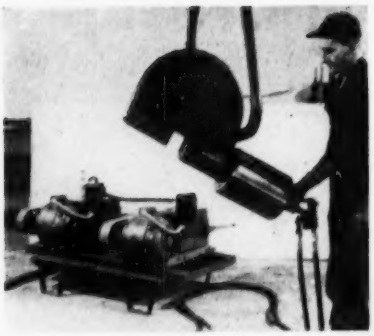
6-3200 West Davison Avenue • Detroit 6, Michigan

ESTABLISHED 1910

Offices in Principal U. S. Cities—Agents Throughout the World

WHEEL TRUEING TOOL COMPANY OF NEW JERSEY
33 West Street, Bloomfield, N. J.

WHEEL TRUEING TOOL COMPANY OF CANADA, LTD.
575 Langlois Ave., Windsor, Ont.



Mobile Cutter Has 150 Tons Thrust

Portable model 25-EE suspension-type guillotine cutter processes up to 2¾-in.-dia steel rod in 13 seconds. Also adaptable for riveting cold rivets up to 1 in., and for punching and pressing.

Manual lever control eliminates solenoids. Unit provides a 360° swivel; cutting head weighs 470 lb. Two electric hydraulic pumps mounted in tandem provide 150 tons thrust.

Manco Manufacturing Co, Bradley, Ill

Carbide Tool Wear and Breakage Controlled by Accurate Device

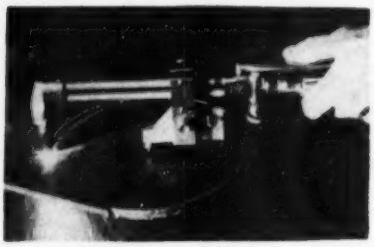
Loadmeter, a device for controlling wear and limiting breakage of carbide tools, works on the ammeter principle to refect motor capacity and percentage overloads.

Overload recorded when the tool is dull is first determined by visual inspection of the tool; an auxiliary red pointer can then be set by the operator with instructions to change tools when the unit's black pointer reaches the red one.

Instrument can be set for any motor ranging from 1 to 50 hp; entire dial is then focused to that specific motor; it can be returned to the manufacturer for change to a motor of a different rating, at a nominal charge.

Through damping the current transformer, Loadmeter provides protection against burnout under starting load. Rotating flange on back of the case facilitates mounting on wide variety of machine tools.

Detroit Milling Cutter Co, 28625 Grand River, Farmington, Mich



Cutting Guides Aid Flame Cutting

Low-cost guides, clamped onto steel plates, support gas welding torches to help in cutting straight lines, bevels, and other shapes with accuracy. A sliding bracket (made in styles to fit any torch) rides along the guide, carrying the end of the torch with it.

Circle guides for diameters from 1 to 66 in. are available.

New Era Mfg Co, 458 W 29th St, Chicago 16, Ill

Lightweight Pneumatic Drill

Mall PD-304P lightweight pneumatic drill has been designed for heavy-duty operations with maximum power on continuous runs. Contoured pistol grip, trigger throttle, and built-in speed regulator facilitate handling. Unit has a built-in oiler, and all moving parts operate on precision ball bearings.

Drill is 6 13/32 in. long, 2 1/16 in. high, and weighs 3 lb; equipped with a ¼-in. Jacobs chuck, key, wrench, hydraulic fitting, air hose and lubricant.

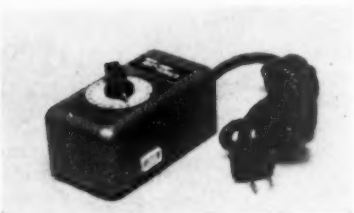
Mall Tool Co, 7725 S Chicago Ave, Chicago 19, Ill

Miniature Pneumatic Transmitter

Miniature pneumatic transmitter is available for measuring and transmitting readings of temperature, pressure, vacuum, differential pressure, and liquid level to recording, indicating, and controlling receivers. Transmission is by means of air pressures of between 3 and 15 psi that have a direct relation to the measured quantity.

Bristol Series 650 uses standard measuring elements and a simple transmitting mechanism with only one pivot and no flexures. Transmitter is sensitive to extremely small changes in the measured value, as little as 0.03% of range, including reversal. Pneumatic relay used has output capacity of 3.0 scfm. Unit weighs 7½ lb.

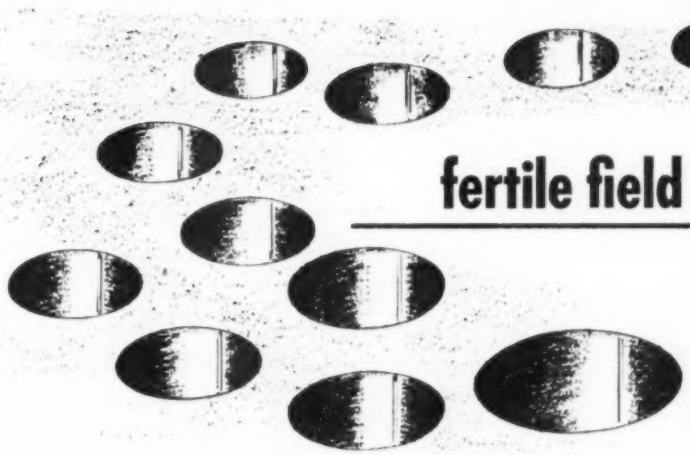
The Bristol Co, Waterbury 20, Conn



Preheat Timer Has High Rating

Loads up to 1650 watts can be controlled by a 20-hr timer developed for use with electric heating pots, tumblers, bake ovens, and other electrical equipment. Two-Timer model 2T-20 may be pre-set to turn on or off a properly rated device as far as 20 hours ahead of time.

Vocaline Co of America, 59 Coulter St, Old Saybrook, Conn.

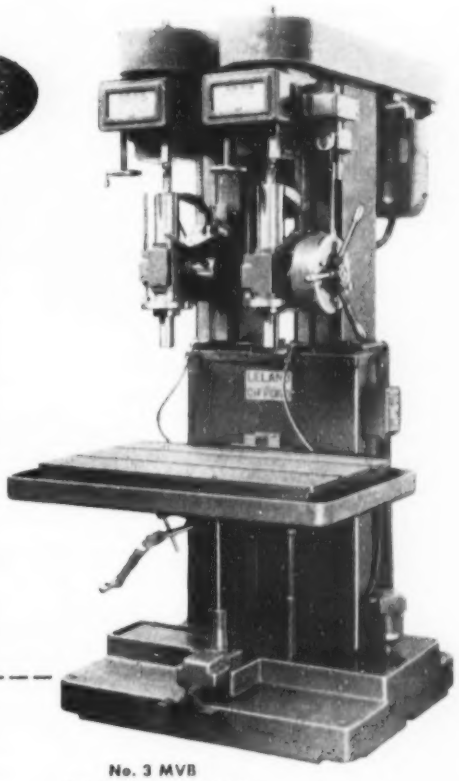


fertile field for cost cutting....

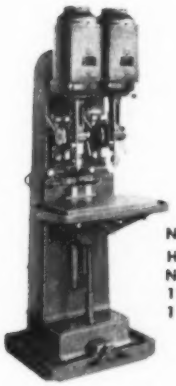
Think of all the HOLES you drill per year

If you want to save money, start where the chances are best . . . *with your drilling operations!* Even a slight reduction per hole adds up fast when you think of the holes you drill per year. But these new Leland-Gifford drilling machines will give you much more than a "slight" reduction. They're miles ahead of anything built twenty, ten or even five years ago.

Fast, powerful, rugged yet sensitive, each is capable of handling a wide range of work. All have new features that make for easier operation, faster work handling, greater accuracy and quicker adaptability to changing production requirements.



No. 3 MVB
Holes from ¼" to 1½"
24" Swing 1 to 4 Spindles



No. 1 LMS
Holes from
No. 80 to 5/16"
12" or 20" Swing
1 to 6 Spindles

No. 2 LMS
Holes from 1/16" to ¾" 20"
or 26" Swing 1 to 6 Spindles

If you drill precision holes, you can't make a more profitable investment than new Leland-Gifford Drilling Machines. Write for complete information.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

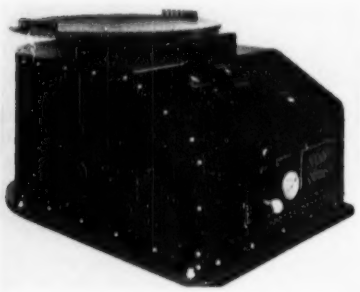
Pressure-Balancing Valves

A new line of low-pressure relief and vent valves is particularly adaptable for use in lightweight, hermetically sealed containers used for shipping delicate electronic and other types of equipment sensitive to environmental damage.

Used as pressure balancing valves, they prevent over-pressuring or under-pressuring of containers which would result from internal or external temperature changes. Units can hold pressure below valve opening pressure, with zero leakage, for indefinite periods of time, by means of the circle seal principle, a feature of the company's check valves.

P-249 (illustrated) prevents excessive build-up of internal pressure; P-262 operates when outside pressure exceeds internal. Units can also be used as vacuum breakers or breather valves, where precise opening is required, but leakage in the reverse direction cannot be tolerated.

James-Pond-Clark, 2181 Foothill Blvd, Pasadena 8, Calif



Gyro Calibrator Has Friction Drive

Calibrating and evaluating rate gyros and similar equipment is done with a new rate-of-turn table operated by a synchronous motor and friction drive. The table is rotated at from 0.01 to 1200 deg/sec by a single control that makes 36 turns for full-scale traverse.

Speed-indication accuracy is within 1% of actual rate, and is read off a 25-in. scale that is coupled directly to the speed-controlling leadscrew.

Genisco, Inc, 2233 Federal Ave, Los Angeles 64, Calif

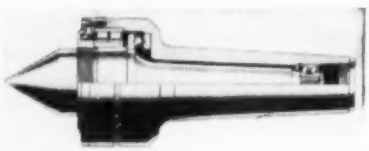
Metallic Lubricant

Molub-Alloy is a form of lubrication which employs petroleum as a vehicle instead of as the primary lubricating agent. It is manufactured in a wide range of types and weights from a variety of base materials to which micron-sized particles of self-lubricating metallic solids have been added, acting as ball bearings.

One of the metallic solids used is molybdenum disulphide, a lubricant resistant to water, high heat, pressures, and temperatures, and highly adhesive to metal surfaces.

Product is manufactured as a grease in standard NLCI weights; also available in all weights of oil for applications ranging from heavy, exposed gears to high-speed spindles.

Imperial Oil & Grease Co, Inc, 6399 Wilshire Blvd, Los Angeles 48, Calif



Ball and Roller Bearing Center

Red-E SKF ball and roller bearing center is designed for heavy-duty work. Radially, the two double row bearings provide rigid support for the shaft, assuring chatter-free operation. Thrustwise, single row bearings eliminates shaft movement in either direction.

Center has sealed-in lubrication.

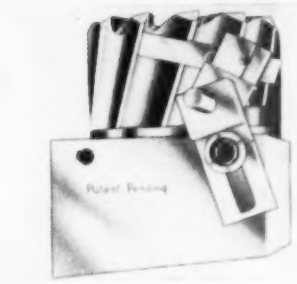
Ready Tool Co, 554 Iranistan Ave, Bridgeport 5, Conn

Kit Includes All Elements For Producing Powdered Metal Parts

A packaged kit for production of powdered metal parts is available. It consists of an electric-motor-driven hydraulic press of 100,000-lb capacity on the ram, a standard bushing, die, one 10-lb bag each of powdered metal mix to produce brass, bronze, iron alloy, and pure iron parts. Also included are a balance and weights, and full instructions.

The press may be used for a variety of production, maintenance, and test applications; pump and ram may be disassembled for use as a high-capacity hydraulic jack for miscellaneous jobs.

Matachem Laboratories, Inc, 6301 Indianapolis Blvd, Hammond, Ind



Fixture Converts Surface Grinder into Cutter Grinder

Fixture for grinding and sharpening the teeth of shell mills, side teeth of side milling cutters, and inserted tooth milling cutters, converts a surface grinder into a cutter grinder.

The inexpensive, easily-operated device eliminates tearing down costly setups on cutter grinders. There is constant duplication of all clearance angles. Work lies in a vertical position, allowing operator to see at all times what he is doing.

Westcott Chuck Co, Oneida, NY

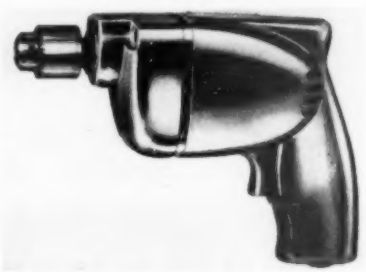
Sunicut Cutting Oils

Four new Sunicut non-emulsifying cutting oils are being marketed which keep parts and tools up to 50 F cooler.

Sunicut 11-S and 209-S are non-staining, dual-purpose oils developed primarily for medium-duty and heavy-duty operations on automatic screw machines.

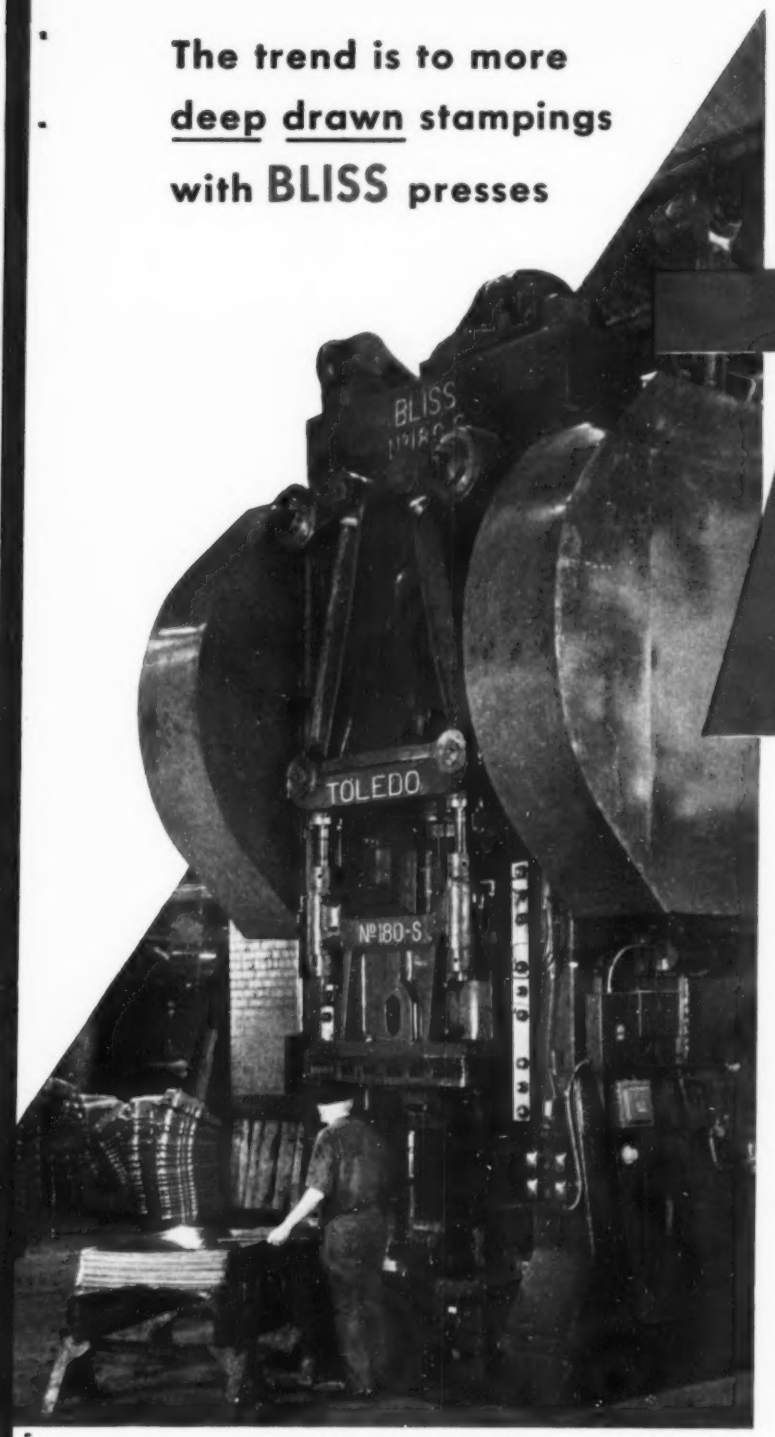
Types 102-S and 110-S both contain active-type sulfur, and are especially effective for heavy-duty screw machine work, and for other operations such as broaching, gear-hobbing, threading, and tapping.

Sun Oil Co, Philadelphia 3, Pa



BALL-RITE ELECTRIC DRILLS, available in a new low-cost line, have hardened gears, Cummins double-coil motor, full-grip handle, and geared chuck.— *Cummins-Chicago Corp, 4740 N Ravenswood Ave, Chicago, Ill*

The trend is to more deep drawn stampings with BLISS presses



Bliss 650-Ton Single-Crank Toggle Drawing Press, latest addition to Transue & Williams' press room, is producing deep drawn stampings at rate of five strokes per minute.

74%

of presses at Transue & Williams are BLISS-built!

As specialists in deep drawn parts, Transue & Williams of Alliance, Ohio, require dependable and specialized production facilities to make full use of their widely-recognized designing ability. So it's significant that they depend largely on Bliss for presses.

Of the 35 presses in the T & W shop, 26—or 74%—are Bliss-built. And practically all the larger presses, including a new 650-ton draw press, are of Bliss manufacture.

Transue & Williams average nearly 200 deep draws an hour on their Bliss presses. For *extremely deep* draws, they find that a particularly valuable feature of these presses is the combination of hydro-pneumatic die cushion and positive knockout in the bed.

The outstanding advantages Transue & Williams get in Bliss drawing presses result from Bliss' long experience in building this type of equipment. *Whatever* type of press you need, why not call in a Bliss engineer? You'll find that Bliss builds it—and builds it better.

E. W. BLISS COMPANY, CANTON, OHIO
E. W. Bliss (England) Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France
PRESSES, ROLLING MILLS, SPECIAL MACHINERY
U. S. plants at Canton, Salem, Toledo, Ohio; and Hastings, Michigan
Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Company, Seattle. Other dealers in United States cities and throughout the world.

BLISS

ON YOUR PRESS IS MORE THAN A NAME...IT'S A GUARANTEE!

Di-Acro Power Rod Parter Cuts 1/16- to 5/8-Inch Bars

Improvements in the Di-Acro power rod parter include the replacement of the air-operated power unit with a motor-driven flywheel. The flywheel drive, operating at 180 strokes per minute, provides six times the cutting speed previously available.

An ejectomatic gage allows the separate operation of gaging, ejecting, and cutting to be performed in a single working cycle. Rods and bars from 1/16 to 5/8 in. can be cut as fast as the operator can feed stock through the cutting heads and engage the foot clutch. Rate of production varies with length of stock to be cut.

Special heads for cutting square, rectangular, hexagonal, and other shaped bars can be supplied. Price $505.

O'Neil-Irwin Mfg Co, 512 Eighth Ave, Lake City, Minn

Bandsaw Blades Cut Tough Alloys

Several new Milford Rezistor bandsaw blades are being marketed for work on stainless steel and other hard alloys. These are made from red-hardness HSS, and are particularly designed for cutoff work on a production basis.

Not all current bandsaw machines are suited for operating with the new blades; therefore, they are being introduced on a rental-performance basis. Blade sizes are ¾ and 1 in., with 6 tpi, and with tempers selected for the applications involved. Manufacturers interested in trying the blades, and in an engineering study of the application to determine cost savings, may contact:

Henry G Thompson & Son Co, New Haven, Conn

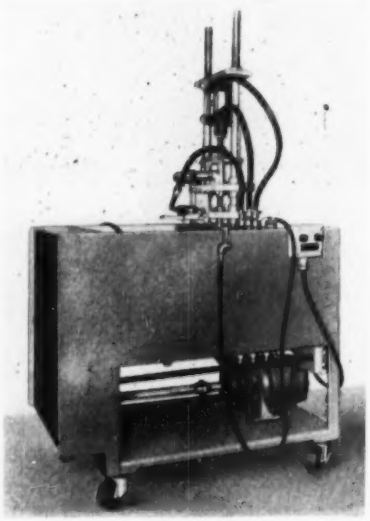
Tacony Graded Files

A set of 18 graded files is micrometer checked to thickness tolerances. Each of the equalling files—no taper in width or thickness—is 4 in. long and ½ in. wide, with thickness ranging from 0.0072 to 0.009 in.

In manufacture, micrometer checks at nine points on each file hold thickness tolerances to 0.0007 in. in the thicker grades, and 0.0004 in. in the thinner files.

Micro-Files have been sucessfully used as hand broaches for precision slot filing. The flexibility of the thinner files is useful in reaching inaccessible spots. Price of 18 files in a vinyl film envelope: $12. Standard kit with slightly wider tolerances: $8.

Tacony File & Hardware Co, 2815 N 4th St, Philadelphia 32, Pa



Palmer Quenching Machine Case Hardens Die Holes

An automatic, controllable cycle of operation is provided on the ID hole quencher. The heater die-blank is placed on the anvil, air-operated rams contact above and below holding a fitting against the die. Brine or other quenching solution is pumped through the die hole to provide required hardness, then a kick-out ram pushes blank into tank for overall cooling.

All timing, temperature, and pumping operations can be set on a predetermined cycle. Adjustable to handle holes with 1/16- to 3-in. ID in blanks ¼- to 8-in. OD and from 1/16 to 6 in. long.

Palmer Manufacturing Co, Cleveland, Ohio

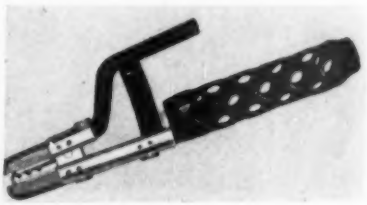
Portable Oven Has Eight Compartments

Model PL 2A, an 8-compartment unit, has been added to the Grieve-Hendry line of portable electric ovens. Latest addition has been designed to permit separation of different sizes or types of products while drying, baking, or preheating.

A primary application is moisture stabilization and storage of low hydrogen, stainless steel, hardenable steel, and other welding electrodes.

Portable unit has adjustable temperature control to 325 F; operates from 110-v ac outlet; fan-driven circulation of air forces moisture out. Model is 30 in. wide, 25 in. deep, 24 in. high.

Grieve-Hendry Co, Inc, 1815 W Lake St, Chicago 12, Ill



400-amp Electrode Holder

Cooltong insulated electrode holder, under test conditions, remained cool enough to weld with bare hands when using its full 400-amp current.

Nose is a special sandwich construction consisting of a copper core between four and six layers of laminated, glass-impregnated, plastic cloth. This core dissipates heat, preventing concentration in the hose which causes insulation deterioration.

Jaws, covered similarly, are made of non-spatter metal; they handle electrodes from 1/8 to 5/16 in. in size, and have wide opening to permit fast release of stubs. Unbreakable handle is perforated to provide super-ventilation and reduce heating from induced currents when welding with ac.

The Lincoln Electric Co, Cleveland 17, Ohio

ALEMITE OIL-MIST

extends bearing life 11 times!

Steel Maker saves

$220 per Week.

Eliminates Lubrication Downtime

High-speed bearings on a key production machine burned out regularly—*week after week*. Tedious hand lubrication, man-hours for repairs, machine downtime, and cost of new bearings piled up. To end this expense, the company turned to Alemite—installed Oil-Mist equipment costing little more than a hundred dollars. *Result:* A savings of $220 in the first week. Today—after 11 weeks of operation, the bearings show *no sign of wear*; only 3 ounces of oil are used per shift where a pound and a half of grease were required before!

Facts prove this *"Friction Fighter"* most efficient, continuous, fully automatic lubrication system

Again, Alemite proves world leadership in lubrication with Oil-Mist, the system that *atomizes* oil into mist—distributes it through tubing to bearings—bathes all bearing surfaces with a cool film of clean oil. Amazingly efficient, the lubricator has no moving parts—and, the human element in lubrication is removed.

Thoroughly tested in countless applications throughout all industry, Oil-Mist—as facts prove—uniformly maintains oil film on plain and anti-friction bearings, gears and chains despite variations in load, temperature or speed. Don't you owe it to *your* business to learn all about Alemite Oil-Mist—*today?*

ALEMITE OIL-MIST Lubricates All Types of Mechanisms

Alemite OIL-MIST Lubrication

A PRODUCT OF SW STEWART-WARNER

Compare all these OIL-MIST advantages with *ordinary* methods!

- Reduces bearing temperatures as much as 20%.
- Continuous, uniform lubrication of all types of bearings.
- Air pressure seals bearings against dirt.
- Reduces oil consumption—up to 90%.
- Prevents product spoilage.
- Eliminates guesswork—each bearing picks up as much Oil-Mist as it needs.
- Reduces starting and running torque.

Get the facts NOW!

Alemite, Division of Stewart-Warner, Dept. C-2
1850 Diversey Parkway, Chicago 14, Illinois

☐ Please send me a FREE copy of your new and complete Oil-Mist Catalog.

☐ Please have your Alemite Lubrication Representative arrange a desk-top demonstration of Oil-Mist. This entails no cost or obligation on my part.

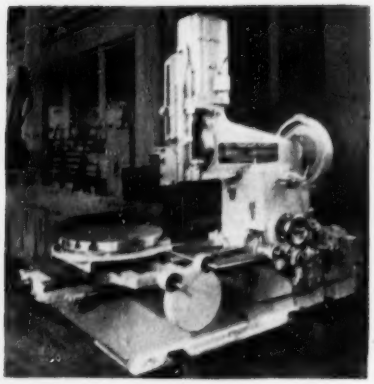
My name .....

Title .....

Company .....

Street .....

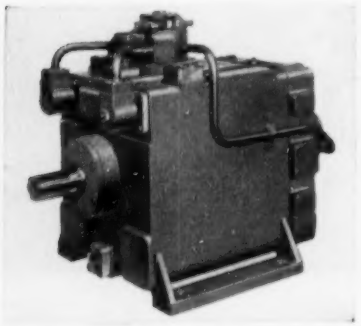
City ..... State .....



Dill Slotter Changed

Design changes in the Dill slotter include a completely enclosed counterweight on the ram. A bank of counterweights slide up and down within machined housing. Forced feed lubrication, supplied by two hand-operated oil pumps, circulates oil to all moving parts. A new gear guarding arrangement encloses all moving gear banks in sections.

Lobdell United Co, Wilmington 99, Del



High-Pressure Pumps and Motors

Heavy-Duty Series of positive-displacement axial piston pumps and motors are suitable for either open or closed hydraulic circuits. They are particularly adapted to heavy machinery drives requiring precise control of torque, acceleration and deceleration, speed, or reversal. Hydraulic motors in this series are said to be outstanding for ability to reverse quickly under full load, and to run at extremely slow speeds under full torque.

Applications include extra large presses and machine tools, rotary drives, and flying shears.

Units are available in ten sizes with capacities of 28 to 2300 gpm at rated speeds, and 50 to 4000 hp in the pressure range of 2000-3000 psi.

Waterbury Tool, Div, Vickers Inc, Commercial Hydraulic Dept, Waterbury, Conn

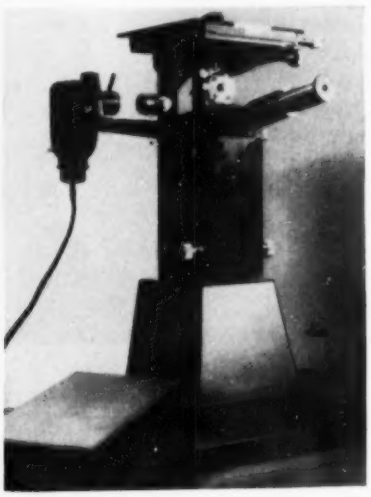
Magnetic Parts Elevator Connects Conveyors

Two-level conveyor systems, machines at different levels, and odd-level mechanisms of any sort in the shop are served by the Magnavator, a parts-elevating mechanism. It is a portable unit, electrically operated, for connecting any odd-level flow units in a production line.

Alnico magnets in a non-magnetic container at the end of an elevating arm grip the parts to be lifted. At the top of the stroke, the magnets are moved up, which strips the work and lets it fall to a chute at the side of the unit. From here the work can be guided to a conveyor or machine.

The unit is capable of random pickup, can operate close to the floor, and will handle hot parts.

Prab Conveyors, Inc, 19875 Mach Ave, Detroit 36, Mich



Inverted Microscope For Surface Inspection

Melabor inverted metallurgical microscope is equipped for instantaneous changeover from bright to dark ground illumination. The 15x15-cm mechanical stage traverses in two directions with scales and verniers; specimen is automatically aligned perpendicular to optical axis.

Coarse focusing is done by rack and pinion; fine adjustment by micrometer screw with 0.001-mm measuring drum. Unit is designed for magnifications ranging from 40 to 2200 times.

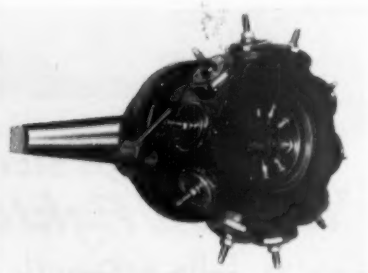
William J Hacker & Co, Inc, 82 Beaver St, New York 5, NY

Improved Spray Head Fights Plant Fires

Modifications in the design of frame and deflector of discharge waterways for industrial sprinkler systems are being incorporated in new fire-fighting systems. This is the first major change in sprinkler design in 75 years, and may result, after some months of operational experience, in new standards in existing underwriters' codes.

Superior distribution and breakup of water into drops and fine spray are claimed for the new heads. These are pendent heads, installed at the ceiling for vertical coverage of the floor and for some lateral coverage of walls.

Automatic Sprinkler Corp of America, Youngstown, Ohio



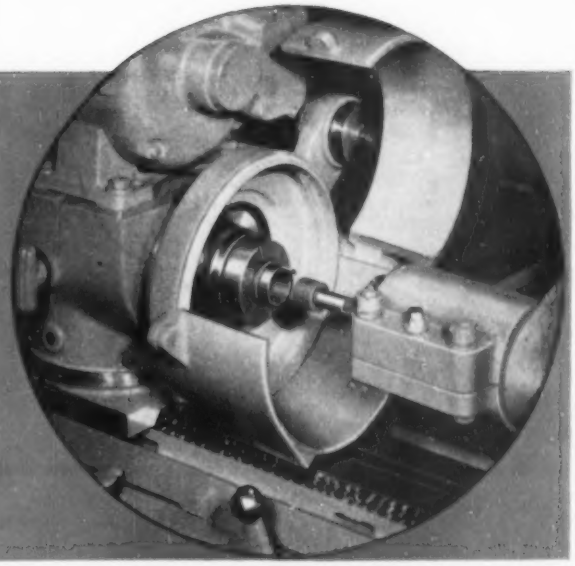
Spline-Cutting Attachment Works on Drill or Lathe

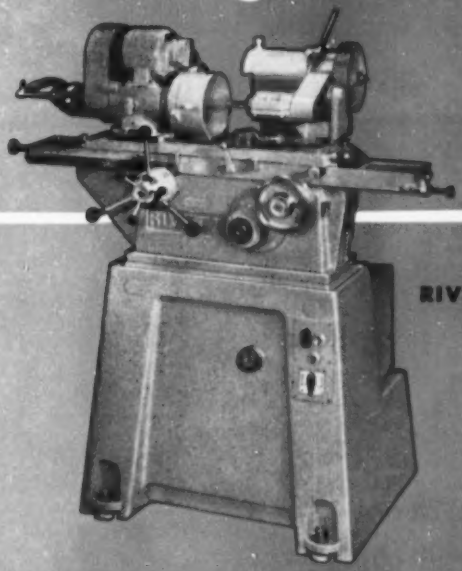
A cost-cutting rig for machining flutes, straight or spiral, has been developed to be operated by unskilled personnel. It is capable of fluting taps, reamers, spotfacers, counterbores, and special cutting tools.

A taper shank is provided for mounting the attachment in a drill-press. Additional duties of milling square, hex, and octagon shapes are possible with the device. Splines may be continuous, or can be interrupted.

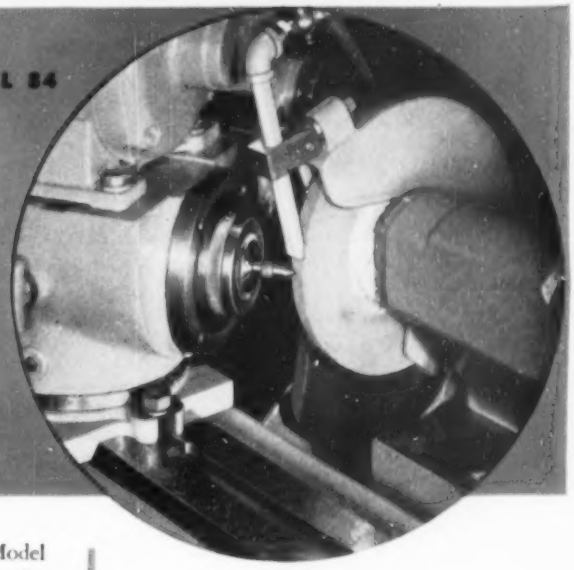
Earle G Boyer, Box 4909, Philadelphia 19, Pa

A new small hole grinder





RIVETT MODEL 84



Easily converted for external grinding

Flexibility keynotes this new Rivett Model 84. Primarily a small hole grinder, it may be equipped for external grinding. Simplicity reduces set-up time on the variety of work normal to the toolroom and die shop. Collets and step chucks quickly mount single or repetitive pieces.

The new Rivett 84 grinds holes from the smallest up to 3" diameter, with a maximum 4" depth depending upon diameter; external work to 3" diameter by 4" length.

If you need versatility with extreme accuracy, you will want to learn more about this new grinder. Send for Catalog 84.

FEATURES

- ★ Optional Wheelheads for internal and external spindles.
- ★ Internal Spindles 12,000 to 35,000 r.p.m.; sealed from grit and pre-lubricated for life.
- ★ Lathe-Type Workhead Spindle mounts draw-in collets and step chucks directly.
- ★ Micrometer Table Stop for positioning work when shoulder grinding.
- ★ Mechanical Power Table Travel with infinite adjustment of speed and stroke.
- ★ Hand Table Travel with coarse and fine feeds graduated to .001".
- ★ Hand Infeed with coarse adjustment to .001", and fine to .0001" reduction of work diameter.

RIVETT LATHE & GRINDER, Inc.

Dept. AMR-3, Brighton 35, Boston, Massachusetts

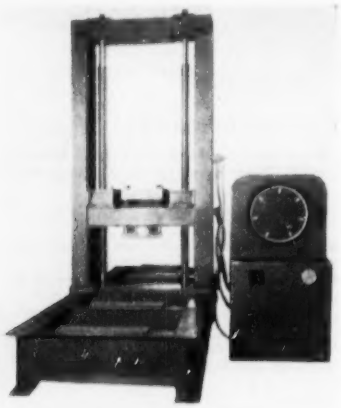
- For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools

Perkin-Elmer Collimator

A jackknife auto-collimator for the precise measurements of angles, parallelism, and surface quality of metals, plastic, or glass, is said to have an accuracy greater than 6 seconds.

The collimator has a folded optical path permitting all components of the instrument to be housed in a single casting. Optical characteristics are the same as those of an 80-mm dia telescope with a focal length of 960 mm and an aperture of f/12. The standard eyepiece has a focal length of 12 mm giving a magnification of 80X. Other eyepieces for reduced magnification and micrometric focusing are available.

The Perkin-Elmer Corp, Norwalk, Conn



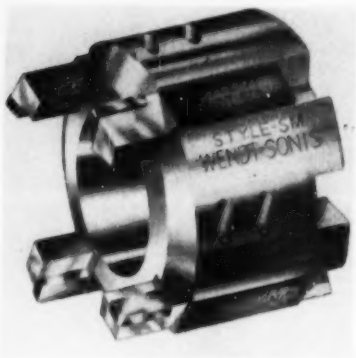
Large-Load Testing Unit

This 200,000-lb universal testing machine has been designed for large pieces of work; the floor-type unit has a finished machine pad bed of 4x15 ft.

Crosshead is driven by a Thymotrol motor mounted directly, instead of at the bottom of the machine. Raising and lowering is on fixed screws, permitting a more direct and rigid drive with considerably less torsion in the screws.

Speed range of the motor is 20:1, providing an overall loading speed of 0.025 to 0.5 in. per minute, and a high traverse speed of 15 in. per min. Special flexure plate construction in each plane allows eccentric loads to be used.

Young Testing Machine Co, Skelton Bldg, Bryn Mawr, Pa



Wendt-Sonis Shell Mills Have Inserted Carbide Blades

A new standard line of inserted-blade shell mills includes sizes from 3- to 6-in. dia. in 4- and 6-blade styles. Two styles of blades are available for steel, non-ferrous and cast-iron milling.

Blade slots are finish-ground to precision tolerances. Blades are ground on both locating sides for minimum run-out when tool is in operation. All carbide cutting edges are diamond lapped. Blades can be removed for free-hand grinding to a templet or precision ground in the cutter body.

Wendt-Sonis Co, Hannibal, Mo

Protective coating, called Spray-Strip, can be applied to wood or metallic surfaces, dries in 20 minutes and strips off in a single sheet. Applied by spray, brush, or dip method, it is said to be impervious to acids, alkalies, greases, and oils and affords protection against vapors and abrasion.

Eagle Chemical Co, Industry Ave, Joliet, Ill

NW nylon is a specially treated fabric for anode bags and diaphragms. Cloth increases life and reduces replacement cost of bags and diaphragms used to screen anode-sludge from plating solution. Said to have greater resistance to chemical action and abrasion than other fabrics, and does not become salt incrusted.

Hanson-Van Winkle-Munning Co, Matawan, NJ

Agitene, a metal parts cleaning solvent now contains Tergene, a detergent compound for use in various types of equipment and for cold-dip tanks. Has a flash point of 110 F, is non-toxic, and does not require a water rinse. Removes cutting oils, lubricants, grease, and sludge. Available in 5-, 30-, and 55-gal. drums.

Graymills Corp, 3707 N Lincoln Ave, Chicago 13, Ill

Impregnated, flame-resistant canvas curtains and blankets that can be hung to screen off dangerous operations are available in sizes to over 100 sq ft. Curtains are made to individual requirements from duck or asbestos cloth equipped with brass grommets a foot apart on one long side; blankets have grommets in each of the four corners.

Eastern Equipment Co, Inc, Willow Grove, Pa

NEMA 1-A enclosure is now being used to make General Electric ac combination motor starters lint-tight. Oil-resistant rubber gasket fits over the edge of control case; when cover is closed, the gasket acts as a seat on which cover rests, forming a close seal. Inspection can be accomplished without opening the control case.

General Electric Co, Schenectady 5, NY

Anti-fog liquid for use on glass and plastic surfaces cleans and treats in one application. Composition contains silicones, no alcohol or glycerine. Fog-Free is packaged in 4-oz squeeze-spray plastic bottles, and in bulk units for dispensers.

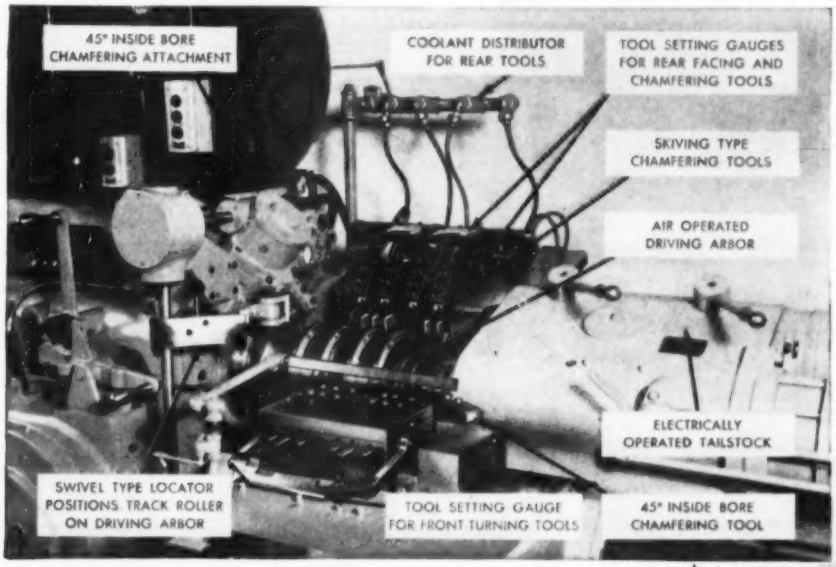
Industrial Products Co, 2844 N Fourth St, Philadelphia 33, Pa

A 3/32-in. dia pull-through blind rivet for installation by one person from one side of the work is available with nickel-plated brass sleeve for tacking and fitting up purposes. Model 120 hand tool for driving 3/32- and ⅛-in. dia rivets is priced at $16.73 with nose assembly for one diameter of rivet; additional assemblies cost $8.89 each.

Huck Manufacturing Co, 2480 Bellevue Ave, Detroit 7, Mich

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK


45° INSIDE BORE CHAMFERING ATTACHMENT
COOLANT DISTRIBUTOR FOR REAR TOOLS
TOOL SETTING GAUGES FOR REAR FACING AND CHAMFERING TOOLS
SKIVING TYPE CHAMFERING TOOLS
AIR OPERATED DRIVING ARBOR
ELECTRICALLY OPERATED TAILSTOCK
SWIVEL TYPE LOCATOR POSITIONS TRACK ROLLER ON DRIVING ARBOR
TOOL SETTING GAUGE FOR FRONT TURNING TOOLS
45° INSIDE BORE CHAMFERING TOOL

Close-up view of tooling.

Overall view of machine showing rough and finished work.

MODEL R-14 Lo-swing Lathe Cuts Machining Time on Track Rollers

Problem: To automatically turn, face and chamfer Track Rollers in one operation.

Solution: The Model R-14 Automatic Lo-swing Lathe was selected for this job due to its rigid construction and its demonstrated fine performance with cemented carbide tools. The Track Rollers, 9-3/4" in diameter and 9-3/8" long, are held and driven from the rough forged bore with a compensating type, six jaw air operated driver. The tailstock, shown in the withdrawn position in the lower illustration, is electrically operated and has a travel of 16" to facilitate loading and unloading of the rollers on the driver. The upper illustration shows the tooling which consists of six front turning tools, eight heavy rear facing tools, eight small chamfering tools and two chamfering tools for the inside diameter. Note the special cam operated, 45° inside bore chamfering attachment mounted on the headstock of the lathe. Swivel type tool-setting gauges, mounted directly on the tool blocks, reduce tool-setting time. All tools are cemented tungsten carbide operating at cutting speed of 350 ft. per minute. Total floor to floor time for the job is 3.5 minutes each.

Engineered jobs are our specialty, and our staff is at your disposal to assist in solving your turning problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Standard symbols for **PRECISION**

A "mike" and an Allen Key keep steady company wherever precision measurements and precision adjustments go hand in hand . . . and where positive locking and vibration-free performance are important to maintaining precision.

Look for the First Name in precision screws at the Industrial Distributor who stands first in *his* field in your locality. He has the stock, the experience, and a wealth of specific information on applications for precision fastenings that you will find invaluable.

WARNING
Allen-Type screws aren't necessarily Allen-Made.
Get genuine "Pressur-Formed" Allen Head screws in this black and silver box.

Waterless Hand Cleaner

Primarily for use where water is not available, Magnus waterless hand cleaner is said to remove grease, paint, tar, grime, inks. A white stiff jell containing lanolin, it has no odor of solvent or ammonia.

The cleaner is water soluble and can be rinsed off with no oily residue. When water is not available, it may be wiped off with a towel.

Magnus Chemical Co, Inc, Dept AM, Garwood, NJ

Johnson's Wax Develops Water Type of Coolant

Johnson's No. 130 Wax-Cool is a water-type of coolant that contains wax. Tests are said to have shown that it has exceptional lubricating properties and minimizes heat at its source. It is a wax-fortified water emulsion said to provide the same advantages as Wax-Cut, the oil-type coolant containing wax.

Wax-Cool is sold as a concentrate and is mixed with twenty parts of water before use. Packaged in 30- and 55-gal. drums.

Industrial Products Dept, S C Johnson & Son, Inc, Racine, Wis

Molykote-Silicone Grease Mixture

Molykote-Silicone, Type 77, is a grease compound containing Molykote Type Z powder processed with a silicone fluid and stabilizer. It is adaptable as a lubricant for use on synthetic rubber, plastics, leather, nylon, and fiber bearings as well as metals.

It has an operating range for temperatures of -50 to 400 F, for occasional peaks up to 600 F. Above 600 F, the silicone will volatilize leaving Molykote impregnated on the surfaces for effective lubrication up to 800 F.

The Alpha Corp, 179 Hamilton Ave, Greenwich, Conn

Kling Bros Control Stand For Larger Friction Saws

A central control stand for push-button control of their larger friction saws is announced by Kling Bros Engineering Works. All operations and feed adjustments are controlled from this stand.

When a button is pressed, coolant water is automatically sprayed on the saw blade while the carriage moves the blade toward the work. The water is automatically shut off when a forward limit switch is struck, after the material has been

✓ check the price

✓ check the analysis

✓ check the performance

and you'll specify

MUELLER BRASS CO.

tuf-stuf®

aluminum bronze

check the price—TUF-STUF, the Mueller Brass Co. series of aluminum bronze alloys, can be supplied at prices below those of similar alloys. Whether you buy TUF-STUF in rod shapes, forgings or screw machine products you'll save money because these alloys are priced right, machine better and last longer.

check the analysis—TUF-STUF alloys are a high copper base series containing from 9% to 13% aluminum and varying amounts of iron, nickel and manganese. They do not contain zinc and, therefore, are not subject to dezincification. TUF-STUF alloys are available in several grades with a chemical composition, suitable hardness and mechanical properties for many different applications.

check the performance—TUF-STUF alloys are light and strong—about 8% lighter than cast bronze and almost as strong as steel. They have a low coefficient of friction as well as good bearing and mechanical properties. They not only retain these properties but resist oxidation at the high speeds and high temperatures of modern production equipment. They will withstand strong acid attack or the effects of brackish waters and are highly resistant to corrosion.

These alloys can be hot-forged into relatively intricate shapes . . . need little or no machining . . . and the smooth, bright surfaces eliminate costly finishing.

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PORT HURON 23, MICHIGAN

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He's right! A grinding wheel's cutting particles *are* embedded like currants in a bun. But there's more than that to Simonds wheels. The cutting particles are scientifically processed by Simonds. They're accurately sized. They're evenly distributed. Their spacing in the wheel bond is controlled for maximum cutting efficiency on specific grinding jobs. This controlled quality assures *you* of superior performance each time *you* order Simonds grinding wheels, mounted wheels, segments or polishing grain. Write for data book and name of your distributor.

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Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co, Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

cut. The same limit switch also causes the carriage to return to its original position. Safety buttons for stop and reverse are provided.

Valves on the control stand adjust the feed pressure and the speed of the saw carriage.

Kling Bros Engineering Works, Chicago, Ill

Feeler Gages and Sets

An assortment of 27 sizes of feeler gage blades, 10 gage sets, and a dispenser has been added to the Williams line.

Each blade is electro-etched with decimal size, and treated with rust-resistant oil. Individual blades from 0.0015 to 0.040 in. are packaged six to an envelope and are available in 3½- and 12-in. lengths. Gages in a variety of sets containing combinations of sizes for special use may also be obtained.

J H Williams & Co, Buffalo 7, NY

Profile Template

The Adjusto Profile Templet is composed of a number of very fine strips of full hard brass each 0.007 in. thick by 0.070 in. wide. These laminations are held in position by two clamps secured by thumb-screws and springs.

By loosening the thumb-screws, the laminations can be slipped to take the profile form of a casting, forging, or other work. The thumb-screws can then be tightened to hold the profile.

Duncan-West Corp, Box 2092, Chicago 9, Ill

Reid acorn nuts, for use in the construction of jigs, fixtures, and other tooling applications, are made from hexagon cold-finished steel; contact surface is square with the thread. Available in variety of sizes.

Reid Tool Supply Co, 709 Baker St, Muskegon Heights, Mich

Improved, all-purpose 1200 flux compound is available for use with silver solders in brazing of ferrous and non-ferrous metals at all temperatures common to silver brazing. Flux covers work and brazing alloy to prevent surface oxidation; cleans; reduces surface tension of the molten alloy to permit free flow over work surfaces that have been heated to brazing temperature.

The American Platinum Works, Newark 5, NJ

Omicron compass with a 72-in. radius capacity has a steel beam on edge which assures parallel disposition between center pin and scriber. Depression of automatic locking lever moves beam, with positive locking in any dimension. Price, $7.50. Model 12 bow compass opens by pressing trigger, closes by pressing legs together. Settings can be changed swiftly; there are no threads, but a smooth rod. Price, $4.50.

A Patrick Co, PO Box 28, Westwood, NJ

Chainveyor is a fully enclosed, light-duty, continuous conveyor for overhead service. Has no wearing parts; flexible short radius curves and straight tubular track sections are easily installed.

Mathews Conveyor Co, Ellwood City, Pa

Sealtite electrical conduit Type UA has tough, extruded synthetic covering over the flexible metal core to protect wiring against moisture, oil, dirt, chemicals, and corrosive fumes on permanent and temporary installations. Can be cut to required lengths, and bends easily. Available in long lengths in nominal electrical ID sizes ⅜ to 1¼ in. inclusive.

American Brass Co, Waterbury, Conn

Dry lubricant, called Drawcote, forms a dry, protective, and lubricating film on formed metal parts. Stock can be used after long storage periods without reapplication; easily removed by a hot, mild alkali bath. Can be applied to any rough or highly polished surface by dipping, spraying, or flow. Powder is shipped in barrels ready for mixing with water.

Gilron Products Co, 6007 Euclid Ave, Cleveland 3, Ohio

Bushing driver is designed to provide automatic positioning of threaded inserts to the proper depth below the face of the casting. Ball bearing pressure plate prevents backing the insert out after driving. Equipped with ½-in. female square drive to process inserts 0.010 in.

Titan Tool Co, Main St, Fairview, Pa

Flexflyte Green Label is a lightweight tubing with relatively smooth bore and negligible reduction of cross-sectional area in tight bends. Made of rust-resistant wire helix covered with woven fabric coated with a tough resinous compound;

Westinghouse has everything for arc-welding anything... ...anywhere

We can solve all your arc welding problems! Whether the application is one of joining different metals, similar metals, thin metals or heavy plate, Westinghouse can help you find the answer!

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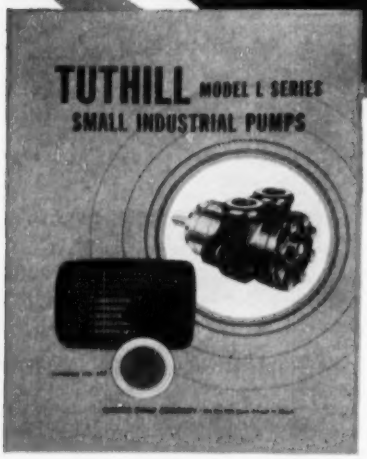

The new Tuthill Catalog No. 101 on the Model L series of pumps presents the information you need to help you in selecting the right pumps for replacements on your equipment. It includes a special Pump Guide on Model L applications, plus complete specifications and performance data. Write for your copy of Catalog No. 101 today.

Tuthill Model L Pumps are designed for LUBRICATING, HYDRAULIC, TRANSFER, CIRCULATING and BURNING OILS SERVICE.

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939 East 95th Street, Chicago 19, Ill.

has good resistance oils, gasses, acids, alkalis, and abrasion, and is flame-resistant. Available in diameters from 1 to 2½ in., in ½-in. increments, and 50-ft lengths.

Flexible Tubing Corp, Guilford, Conn

AMP hand hydraulic tool, which crimps AMP heavy-duty solderless terminals to stranded or solid wire, has interchangeable die inserts for eight wire sizes from No. 8 to 4/0. Toolhead has spring-loaded latch, and 360° axial rotation; cradle permits use as a bench tool. Develops 12 tons of crimping pressure.

Aircraft-Marine Products, Inc, Harrisburg, Pa

Locknut that can be hot-dipped galvanized has been developed for uses where corrosive elements are present. Square-bodied unit holds its position on the bolt by a locking insert. When nut is applied, bolt forces the retainer into the round, causing high-tension grip. Made in sizes from ⅜ to 1⅜ in.

Security Locknut Corp, North Ave & 15th Ave, Melrose Park, Ill

Stacking box has sides and bottom of welded wire fabric to decrease weight and allow for ventilation and drainage. Stacking caps on corner posts permit rapid lift-truck tiering for space conservation. Standard model has a 30-cu-ft content and 4000-lb weight capacity; available in various meshes and sizes.

Equipment Manufacturing, Inc, 21550 Hoover Rd, Detroit 5, Mich

Hard-facing alloy CM-199 resists abrasion at high temperatures and attack by molten copper. Welds over itself and more ferrous materials without cracking, checking, or porosity, permitting patching rather than full replacement.

Coast Metals, Inc, Little Ferry, NJ

Test stand, automatic, air, and hydraulically actuated, determines physical characteristics of any seamed tubing up to 3 in. dia. Specimens can be checked for flaring, column, and crushing strength with pressures up to 100,000 lb. Self-contained unit has hinged safety guard, and connects to 60-80-lb air supply. Operates by solenoid, push-button control after specimen is inserted between fitting anvils.

The Dommers Co, 428 S Cherry St, Wallingford, Conn

use KOPY-KAT duplicating

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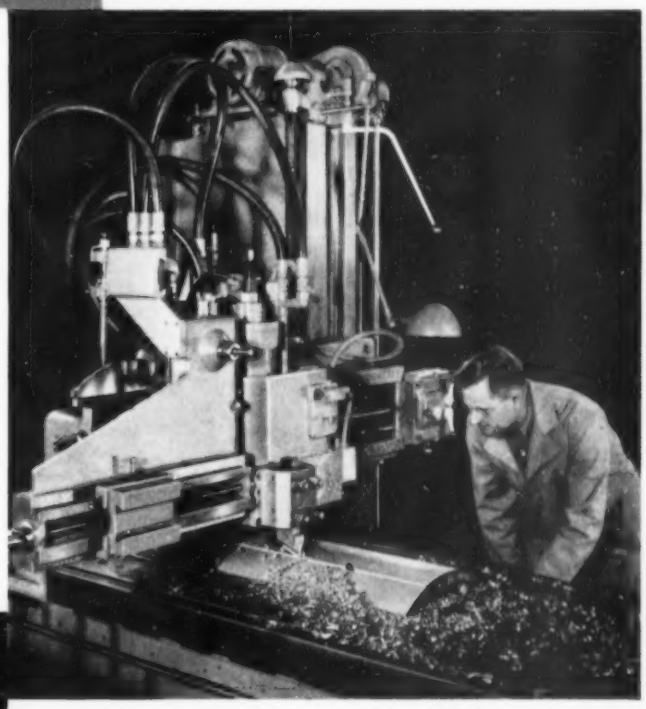
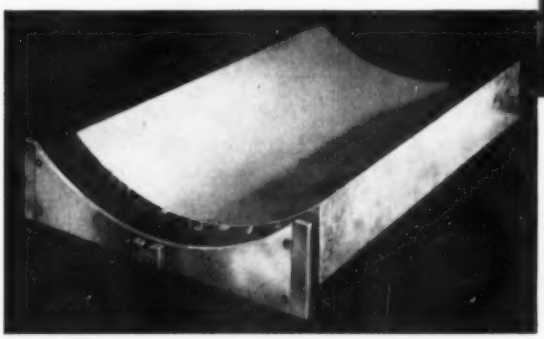
FORM
MACHINING





Kopy-Kat duplicating is a fast, inexpensive way of reproducing identical forms. No expensive templates are needed. Forms are transferred direct.

For the L & W Tool & Manufacturing Co. at Milwaukee, Wisconsin, a Rockford Kopy-Kat machined a mold within limits of ± .002", using a simple flat stock template. They found the surface finish to be excellent, and the best obtained compared with any other method.

The entire machining time, including set-up for both work and template, was 39 hours floor-to-floor for both parts of the mold. The above illustration shows the convex part of the mold being machined. The concave part and the template are shown in the closeup view.

See the Kopy-Kat in action before selecting production duplicating equipment. A Rockford Machine Tool Co. representative will give you complete information.

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Bulletin No. 12A

Hy-Draulic

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ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET ROCKFORD, ILLINOIS

pointing problems?

Torrington Swaging Machines produce pointed ends on both solid and tubular work to close tolerances. The swager, delivering 4000 hammer blows a minute, works rapidly and gives the metal toughness and resiliency. Swaging is economical, too, for there is no stock waste.

"The Torrington Swaging Machine" tells the story on the art of swaging, and describes the complete line of Torrington machines. This informative booklet is yours for the asking.

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Swager Departments
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Makers of
TORRINGTON NEEDLE BEARINGS

Shell Alvania grease, a multi-purpose product, contains lithium 12-hydroxy stearate. Proved to be highly resistant to breakdown, has high water tolerance, broad temperature range, achieves high pumpability and movement at low temperatures, and undergoes no phase change when high melting point is reached. Product has low rate of oxidation, long induction period, and excellent storage stability.

Shell Oil Co, 50 W 50th St, New York 20, NY

Markem 51A machine prints label information directly on cartridge-enclosed fuses. Produces direct ink imprints unaffected by moisture or ordinary chemical atmospheres. Label inventory and wastage is eliminated; print is larger, and brilliant colors simplify coding and identification.

Markem Machine Co, Keene, NH

Edscope stereo-microscope for any inspection operation has a fixed 3-power objective with 3 pairs of matched eye-pieces for powers of 15, 30 and 45X. Has interpupillary adjustment and rack and pinion focusing. Can be removed from base for mounting on equipment or bench. Working distance is 2¾ in., adjustable for extra height. Available on direct order as stock no. 70,011, priced at $75.

Edmund Scientific Corp, 211 E Gloucester Pike, Barrington, NJ

Shaler generator-motor cleaner is a solvent for use on units while they are still assembled. Motor can be submerged in solution, plugged into electric current and allowed to run for from 3 to 5 minutes; after removal, it is dried with compressed air. Solvent may also be sprayed into the intake side of motor while it is in operation. Does not affect wiring or insulation which is gasoline- or oil-resistant.

The Shaler Co, Waupun, Wis

Heavy-duty C washers are available in nine sizes for use with bolts and studs ranging from ¼- to 1-in. dia. All sharp edges are removed and surfaces are flat and parallel.

Reid Tool Supply Co, 709 Baker St, Muskegon Heights, Mich

Gage, which can be used as a height gage, comparator, or scriber, is available in column lengths of 18 and 24 in. Greater post diameter and flanged base facilitate accuracy

New XL BOND
FOR CARBIDE TOOL AND CUTTER
Grinding

EFFICIENT ECONOMICAL
ROUGH GRINDING AND FINISH GRINDING
NEAREST THING WE KNOW TO A DIAMOND WHEEL
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"XL" is Chicago Wheel's exclusive new bond for silicon carbide vitrified grinding wheels, especially made for grinding carbide cutting tools. Supplied in most popular sizes and steel backs. Prompt delivery. Keep your production up . . . costs down, with "XL."

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Dept. AM, 1101 W. Monroe St., Chicago 7

and stability in sustained inspection or quality control operations.

H E Dickerman Manufacturing Co, 32 Albany St, Springfield, Mass

Model 707 safety goggle has an acetate frame designed to retain lens when subjected to severe impact. Wire core temples have cable-wound ends permitting easy adjustment for comfortable fit. Available with flat, 1.25 or 6.00 curve, heat-treated safety lens.

Pennsylvania Optical Co, Reading, Pa

SBS Waterless Washstation, equipped with two paper-towel dispensers, and a dispenser for SBS-30 waterless skin cleanser for removing heavy greases, paints, etc, requires no plumbing and is portable. Receptacle for waste towels is included in the single unit, priced at $50.

Sugar Beet Products Co, Saginaw, Mich.

Automatic emergency lighting unit assures instantaneous light when regular power fails. Trickle charger maintains storage battery built into the portable set; built-in hydrometer indicates state of battery. Unit can be plugged into any ac circuit; 100-cp beam provides 10 hr of light. Model E is priced at $120.50.

General Scientific Equipment Co, 2700 W Huntingdon St, Philadelphia 32, Pa

Brammer V-link belting now has the size symbol embossed on each rivet head, eliminating need for measuring belt sizes. Natural rubber compound increases flexibility of each link, facilitating assembly difficulties; links may be added or removed manually. Smooth finish provides greater surface contact on pulleys.

Brammer Corp, 68½ Broadway, New York 12, NY

Bete spiral fog nozzles have been improved for efficiency and non-clogging action to shear a continuous film of liquid from a solid jet to form a fine fog of uniform drop size. Models available in flow rates from 1 to 1000 gpm.

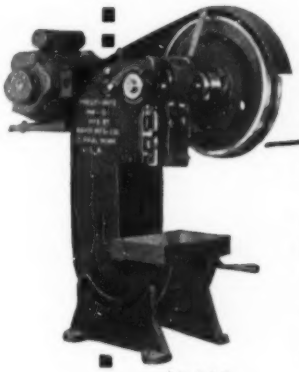
Bete Fog Nozzle Inc, Greenfield, Mass

Nu-Cup set screw has cup point designed to obtain greatly increased holding power with the same amount

If your operations require a small High Production Press consider one of the two...

For
BLANKING
PUNCHING
FORMING
STAMPING

PRESS-RITE
No. 0 POWER PRESSES



Model 0
Bench Model

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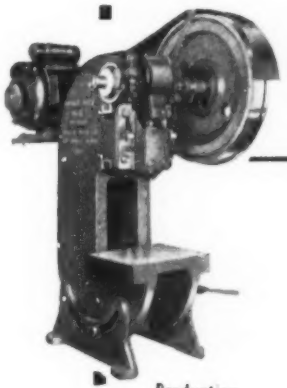
CUT YOUR PRODUCTION COSTS

Rugged and economical, especially designed for manufacturers who need a small but powerful press. Designed with cost cutting features such as:

- **Uni-Cast Frame—to eliminate deflection.**
- **Triple Ramway Lubrication—to insure constant lubrication.**
- **Single Stroke Safety Mechanism—for greater operator safety.**

A complete line from 5 to 85 tons.



Production
Model

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Designed with features found in only the larger, higher cost presses. All the features of the Regular Duty press plus these "big press" features to give you high production:

- **Roller Bearings—for longer wear.**
- **Automatic Cam Actuated Brake—eliminates constant brake drag—permits use of full flywheel power.**
- **4 Point Contact Replaceable Clutch Plate—eliminates lost flywheel motion.**

Hundreds of manufacturers have found that feature for feature you can't get a better press.

A complete line from 5 to 85 tons.

FREE Bulletin fully describing all of Press-Rite's features and giving facts and specifications on the complete Press-Rite line mailed promptly on your request.

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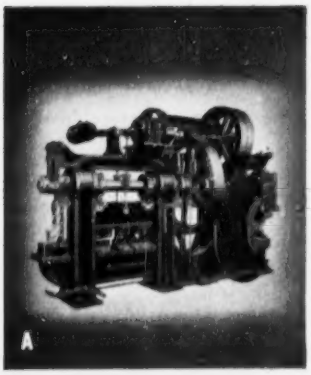
You don't consult the occult when buying new equipment for industry. We're not fortune-tellers but we'll predict a bright future for any plant where BEATTY machines are added to the production lines. If one of the machines shown doesn't answer your particular needs, we'll design and build one that will. Call a BEATTY engineer for experienced help whenever production problems are considered.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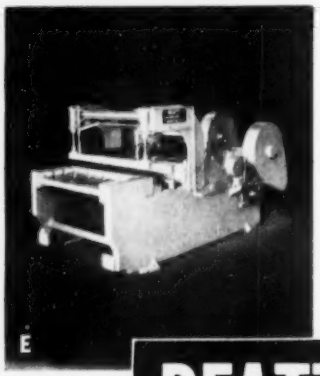
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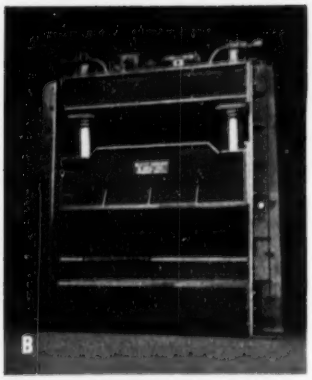
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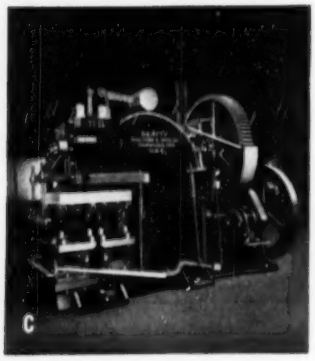

C

BEATTY
MACHINE & MFG. CO.
HAMMOND • INDIANA

A. BEATTY Co-Pun-Shear, one unit that does coping, punching and shearing without changing tools.

B. BEATTY Vertical Hydraulic Bulldozer for hot and cold pressing and forming of heavy metal.

C. BEATTY Heavy Duty Punch that handles steel up to 65 ft. long. Punches webs, and flanges.

D. BEATTY Press Brake and Flanger handles any type of bending, forming, flanging, pressing.

E. BEATTY Horizontal Multiple Punch for line punching of vertical flanges.

of setting torque. Suited to applications in which shaft is soft, or small, in relation to the contact arc of the cup. Available in slotted, headless, and slabbed type.

Set Screw & Manufacturing Co, 13 Main St, Bartlett, Ill

Solo-Phos removes grease and tar, cleans off chips, and provides a rust-inhibitive phosphate coating. Used for one-step cold cleaning and phosphating of ferrous metals, aluminum, and zinc, it reacts with organic or metallic soils. Can be applied by spraying, flushing, or dipping, and after reaction, spray-rinsed.

Whitfield Chemical Co, 14225 Schaefer Highway, Detroit 27, Mich

Wespo bar knobs have been designed to replace standard knobs and handwheels where stronger clamping action is necessary for dies, jigs, or fixtures. Bars inserted between the four prongs permit greater leverage for tighter clamping. Available blank, drilled, and reamed and tapped in a wide range of sizes.

West Point Manufacturing Co, 26935 W 7 Mile Road, Detroit 19, Mich

Haz-Bin, Jr, storage unit is a 128-drawer, 384 compartment cabinet for small parts. Transparent plastic drawers are individually guided; safety catch permits them to hang out for easy access to contents. Model J-128 measures 30½ in. high, may be stacked, used side by side, or back to back.

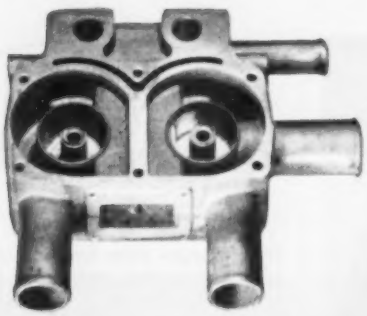
Akro-Mils, Inc, PO Box 989, Akron 9, Ohio

Illinite files for power-filing-machine use are available in a plastic kit containing assortment of twelve basic shapes. Placed in individual pockets, files have ⅜-in. shanks and 4-in. length of cut, 5⅝-overall length, extra heavy to withstand cutting pressure. Priced at $12.

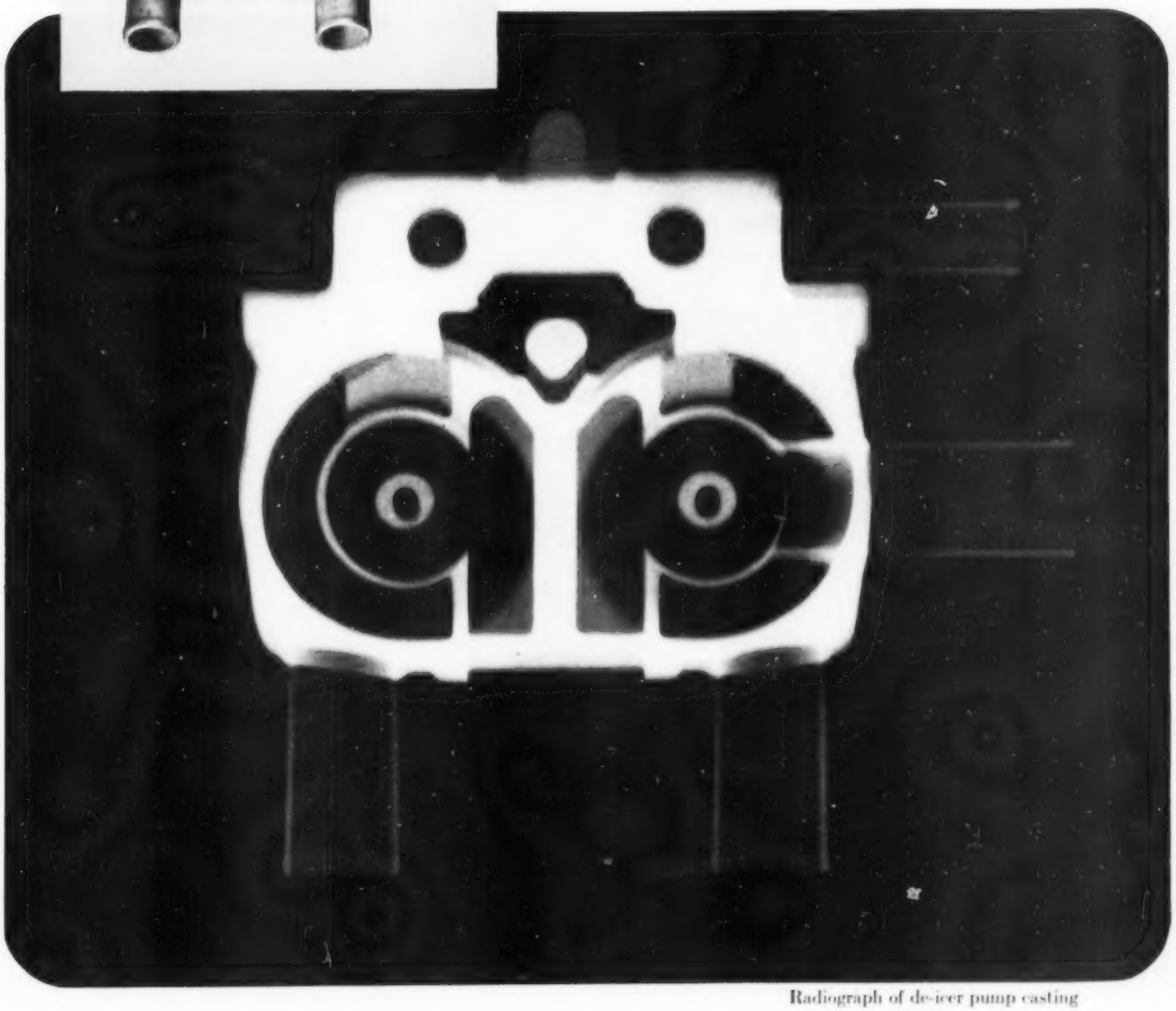
Illinois Tool Works, 2501 N Keeler Ave, Chicago 39, Ill

All-State 5-in-1 electrode for cutting, chamfering, bevelling, piercing, and gouging requires no oxygen, or acetylene, or other fuel gas. Said to process 2½ times faster at the same heats, it can be applied on steel, stainless, iron, cast iron, copper and nickel and their alloys, with either ac or dc. Available in sizes from 3/32 to ¼ in.

All-State Welding Alloys Co, Inc, White Plains, NY



This heart must pulse or the Plane's in trouble—



Radiograph of de-icer pump casting

so it's checked by RADIOGRAPHY

ICE can down a plane as sure as flak. So it's kept from wing-edge and prop by the throbs of this pulsating heart.

Easy to see the importance of this tiny unit—and why its castings must be sound. To make certain, each part is x-rayed. This way weakness cannot lurk in a hidden flaw.

What's more—a part so finely finished calls for careful machining, which would be wasted if x-rays did not first reject any unsatisfactory castings.

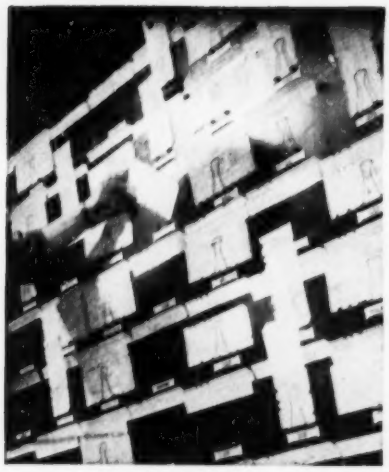
It's another example of why more and more suppliers of castings use radiography. It speeds the establishment of proper casting technics and lets you be sure only sound castings are delivered.

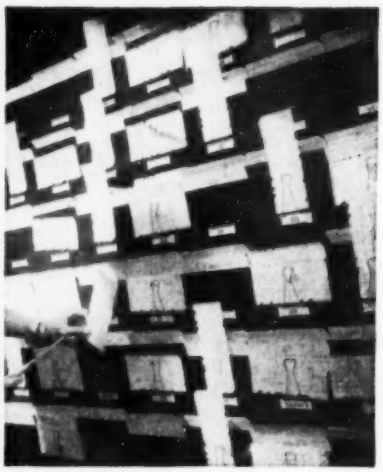
If you'd like to know how radiography can improve your operations, get in touch with your x-ray dealer. Or, if you like, write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography...
another important function of photography

Kodak
TRADE-MARK





One movement of Job Time Ticket on these McCaskey Boards directs dispatcher, move-men, set-up men and operators according to production plan . . . with

NO ASSEMBLY DELAYS FROM MISSING PARTS NO EXCESS WORK IN PROCESS

Barcalo Manufacturing Company, Buffalo, N.Y. has met the problems of dispatching production of a widely diversified line of products . . . from hand tools and metal furniture to pillows and mattresses . . . with McCaskey Machine Loading, Scheduling and Job Assignment.

Shop orders formerly were handled in a "blind file" and one or more parts often were overlooked or delayed with serious results. This is totally eliminated by the use of McCaskey Machine Control Boards and the following procedure developed by W. J. Navelle, Production Control Manager:

1. Job time tickets are pre-written without operators' clock numbers (see paragraph 7) and assigned to machines by Production Control Department.
2. They are placed by dispatcher in rear pockets of McCaskey Machine Control units in sequence specified by Production Control. Load is recorded on load cards.
3. Foreman selects jobs to be run next and moves tickets to front pockets of control units.
4. Dispatcher issues stores requisition for material, attaches to and notes action on job ticket.
5. Material move-man takes requisition to stores, delivers material to or near machine and marks ticket when move is complete.
6. Set-up man checks board, draws tools and dies and marks ticket when job is ready to run.
7. Job is assigned to operator by dispatcher; his number is written and starting time is stamped on ticket. Ticket then is visibly filed under clip spring at front of control unit.
8. When job is finished, dispatcher rings out ticket, enters production summary on permanent record and sends ticket to Production Control.
9. Production Control completes its record and sends ticket to Payroll Department.

Foreman, by quickly referring to McCaskey Board, selecting jobs to be run and moving job tickets thus provides instructions for (1) dispatcher, (2) move-men, (3) set-up men and (4) operators. Jobs are run and essential operations performed according to Production Control's plan. This McCaskey installation once again demonstrates how readily duplicated effort, delays and confusion are replaced by economical, planned production.

Let us talk with you about a McCaskey procedure for your department or plant. Equally adaptable to line or job shop production, assembly, maintenance or individual job assignment. Mail coupon today for complete information.

McCASKEY REGISTER CO.
ALLIANCE, OHIO
Please send me bulletins describing McCaskey Machine Loading, Scheduling, Dispatching and Job Assignment

Name .....
Position .....
Company .....
Address .....
AM 3-53

McCaskey
INDUSTRIAL CONTROLS
PRODUCTION • INVENTORY
TOOLS • COSTS • PAYROLL
THE McCASKEY REGISTER CO.
ALLIANCE, OHIO
McCaskey Systems, Ltd., Galt, Canada
The McCaskey Register Co., Watford, England

ROUND TABLE Discussion

CROSS-CHECK

Is a foreman ever justified in pitting workers against each other as far as producing a specific job goes? Will the men react favorably, or tend to band together and defeat the purpose?

IN GIVING TWO men a similar job to see which man is the quicker, Ed does not seem to realize that this is all he will do. He will know that on this particular job, and this one only, the production capacity of Morrison and Butler are the same or different. He will still be without definite knowledge of the true time value of the job. Accurate knowledge is desirable, but surely this is the wrong approach.

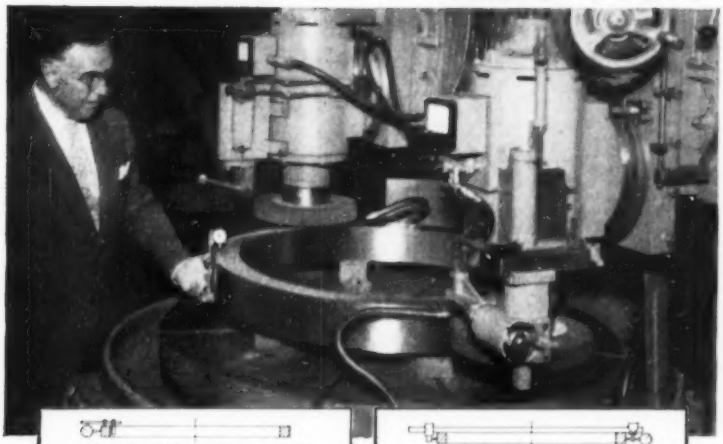
By following this method, is not Ed advertising either his own bad management in not using the same man for both dies, or his ignorance of time value of the work to be done? It would seem that neither Ed nor his boss had ever heard of the use of estimated times, based on tested data, for the removal of material, both in bulk and for finishing, by machine and by hand for small quantities and quantity production. With the use of such data, it would be quite unnecessary to resort to such an indeterminate method as Ed was proposing.

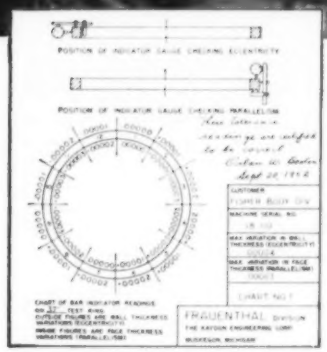
Men's ideas of production possibilities are confined to what they have been accustomed to; that is why some more tangible basis of comparison is needed.

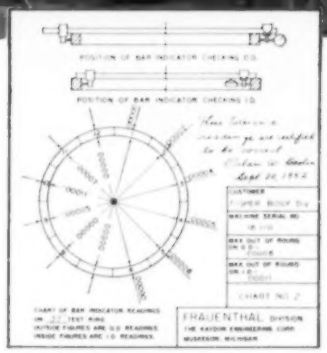
In a large plant, piecework was the system of payment in use; the prices given being guessed at or based on the knowledge of the foreman. One such job was supposed to take one week of 44 hours. The operation was slotting, and thus one machine was permanently tied up. An estimating system of rate-fixing was introduced, and for this operation 12 hours was considered the time value. This figure was laughed to scorn.

There was one man whose leg the writer pulled over his slowness. He felt annoyed, in a friendly way, and said, "Look here, Mister, if you'll stand over me and make it appear I've got to do it, I'll do you one in a day, and every day. But you must make it appear I am being forced, because the foreman fixed the rate."

GRINDING TO millionths* OF AN INCH







* *Our normal method of expressing tolerances in tenths-of-thousandths of an inch became inadequate when precision was attained to fractions of tenths-of-thousandths, expressed best in MILLIONTHS of an inch.*

Utmost precision proved by meticulous tests, and certified by Orlan W. Boston, Chairman, Department of Production Engineering, University of Michigan. He witnessed tests at Fraunenthal plant in Muskegon and certified their validity on precision grinding of a 37-inch test ring, on Fraunenthal Grinder No. 18-110 (shipped to Fisher Body Division for grinding tank bearings).

You get TOP PRECISION with Fraunenthal Grinders

The certified readings listed at left are much closer than the 200-millionths of an inch precision specified for these machines. You can get similar results on other sizes of Fraunenthal Multiple-Head Super-Precision Cylindrical Grinders, up to 140-inch diameter grinding on the Series 2200 machines. Uniformity of precision is assured in concentricity, parallelism and roundness. You can make many combination settings of grinding-spindle positions for a wide variety of simultaneous grindings of outside, inside and faces. Details on request.

PRECISION GAUGE READINGS • CHART NO. 1

MAX. VAR. IN FACE THICKNESS (Parallelism)				MAX. VAR. IN WALL THICKNESS (Eccentricity)			
Station	Reading	Station	Reading	Station	Reading	Station	Reading
1	.000000"	7	.000000"	1	.000000"	7	+.000020"
2	+.000010"	8	+.000020"	2	+.000010"	8	+000010"
3	+.000030"	9	+.000030"	3	+.000020"	9	.000000"
4	+.000030"	10	+.000030"	4	+.000020"	10	−.000010"
5	+.000030"	11	+.000030"	5	+.000010"	11	−.000020"
6	+.000010"	12	+.000020"	6	+000020"	12	−.000010"

Maximum Variation in Parallelism: .000030" Maximum Variation in Eccentricity: .000040"

PRECISION GAUGE READINGS • CHART NO. 2

MAX. OUT-OF-ROUND ON O. D.				MAX. OUT-OF-ROUND ON I. D.			
Station	Reading	Station	Reading	Station	Reading	Station	Reading
1	.000000"	4	−.000050"	7	.000000"	10	−.000110"
2	−.000020"	5	−.000080"	8	.000000"	11	−.000070"
3	−.000040"	6	.000000"	9	−.000050"	12	.000000"

Maximum Variation, Outside Diam: .000080" Maximum Variation, Inside Diam: .000110"

Series 1800

What is YOUR Grinding Problem?

Through more than a decade of toolroom and production grinding, Frauenthal Grinders have been performance-proved on tough precision jobs, such as helicopters, jet engines, army and navy tanks and gunmounts, Diesel engines, machine tools, 120-inch diameter KAYDON precision bearings and similar products. We'll be glad to work with you on difficult grinding problems.

made in 10 standard sizes . . . conforming to essential J.I.C. specifications

	Series 1800				Series 2000		Series 2200			
Table sizes	30"	36"	42"	48"	60"	72"	110"	120"	130"	140"
Maximum Swing	56"	56"	56"	56"	72"	88"	120"	130"	140"	150"

Ask for Bulletin

Frauenthal Division THE KAYDON ENGINEERING CORP., MUSKEGON, MICH.

PRECISION-GRIND INSIDE, OUTSIDE AND FACES SIMULTANEOUSLY

This Cleveland Model E-24 has been on the job day in and day out since July 1949. With one stroke of the machine it completes 2 pieces—Core drilling, countersinking and Tapping ¾ - 10 Thread in Malleable Iron Castings.

It is another example of how production can be speeded up and costs reduced when you bring your production problems to Cleveland. Cleveland engineers can design a machine for you that will cut costs by combining several operations. And when you get a "Cleveland" you get all the proven advantages of the famous lead screw design that means more perfect pieces per hour.

Whatever operations you require . . . Core Drilling . . . Reaming . . . Tapping . . . Threading . . . Chamfering . . . it will pay you to call Cleveland.

Write today for Catalog No. **AR-39.**

THE CLEVELAND TAPPING MACHINE CO.

A Subsidiary of **AUTOMATIC STEEL PRODUCTS, INC.**

CANTON 6, OHIO

For Better Tapping--Faster!

CLEVELAND lead screw **tapping machines**

He did it, earned big pay, and by so doing increased the productivity of a very costly machine by 400%.

An ill-informed foreman is an expensive luxury whether his name be ignorance, or just Ed.

P E James
Lincoln, England

•

COLOR BLIND

How important a factor is color in the shop? Will it improve productivity and safety, even if space and lighting conditions are not ideal? Readers say . . .

PERHAPS THIS idea of painting everything a different color can be carried too far, and many people think so.

We will admit that tinting walls and ceiling is OK, if such an act will make these things easier on the eyes, but a shop is not a Christmas tree, and to try to make it look like one is not so good.

I remember going into a plant where everything, including doors, was colored to a fare-ye-well, but a man, in order to find what he was looking for and where he wanted to go, had to carry a card as large as a hotel menu, and even then he would occasionally get lost and have to inquire as to where he was. Of course, this was a large plant.

A few years back, one night about ten o'clock, a train at a junction of the Pere Marquette and the Michigan Central Railroads, got switched from the Pere Marquette to the Michigan Central.

This was the first time that the PM engineer had been put on this run so he was not familiar with it and, after going about 42 miles he stopped at a station to learn where he was, only to find that he was 42 miles off on the MC, not because it was his fault but because the signal colors were different, though he thought he was OK.

In one plant, there were gates painted yellow at the heads of all stairways so everybody had to unlatch them if they wanted to go down stairs. In another plant every hazardous spot was painted red, which wasn't so bad, but nobody dared to go anywhere for fear of trouble to himself or somebody else.

Crane hooks outside and in plants have been painted red and have carried red lights at night, but men got hurt by them just the same.

Many more instances of painting could be mentioned, but if any man has any sense, he can live a long time without all of this paint business, and

DoALL

PRODUCTION NEWS

SAW BANDS • GAGING EQUIPMENT • TOOL STEEL • CUTTING TOOLS • INDUSTRIAL SUPPLIES

Vol. 2 Published by The DoALL Company, 254 N. Laurel Ave., Des Plaines, Illinois No. 1

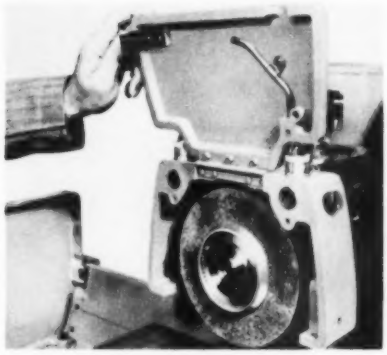
New Features Extend Range of Use of New DoALL Surface Grinders

Many Special Jobs Possible; Machines Grind Precisely to Handwheel Settings; Fully Automatic Grinding Available

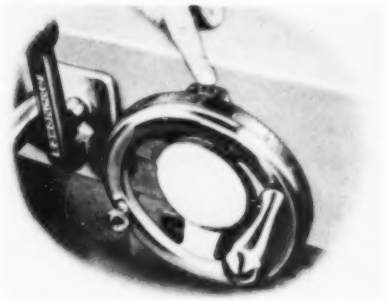
New DoALL Precision Surface Grinders for production and toolroom work are engineered to do an unusually wide variety of work to new standards of speed and accuracy. Construction of the new models is heavier, rigidity is greater.

Precision is such that the operator can grind exactly to handwheel settings. Exact duplication on production runs is possible without removing the work to check dimensions. Handwheels are equipped with calibrated slip rings for quick, easy zeroing.

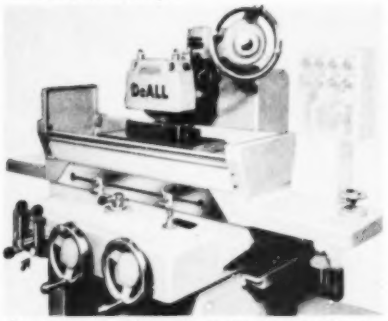
Work height capacity of the new models is 12½". Table speeds variable to 100 feet per minute are standard. Sizes range from 6" x 18" to 10" x 30".



"Cool-Grinding" tubing and controls are built into the wheel housing.



Calibrated slip rings provide quick, easy handwheel zeroing.



Accurately calibrated controls, centrally located for ease of operation.

Optional Attachments

For high speeds and heavy cuts without burning the work, DoALL's patented "Cool-Grinding" as well as flood cooling are available. In "Cool-Grinding" coolant flows *through* the wheel and out at point of cut. The two coolant systems are supplied from a common recirculating system, can be used independently or together.

For high production work, fully automatic grinding including automatic downfeed and crossfeed is available.

When plunge grinding several parts at one time, production can be increased by an automatic skip feed attachment to speed table travel between work pieces, minimizing non-productive time.

A high speed spindle attachment permits work with very small wheels in either vertical or horizontal position.

Heavy duty spindle and slow, powerful table feeds are available for crush grinding. An infinitely variable speed spindle drive provides great versatility. Another attachment permits straight, taper, angular and square grinding of cylindrical pieces.

Attachments for wheel dressing operations are available, including variable speed, uniform crossfeed and a slow, powerful crush dressing spindle drive. Alternate to this drive is a motor-driven crush roll stand. Other attachments and accessories are listed in a new Grinder Catalog.

Grinder Models

Model D6 is a popular size for tool and gage work and ideal for production of small, intricate parts. Wheel size is 7", chucks are 6" x 18" and 6" x 24", a new size for this small grinder.

Model D8 is an intermediate size for production and toolroom use. Chuck size is 8" x 24". Spindle construction makes possible use of both 10" and 14" wheels having the same hole size. Among other advantages, the small hole in the 14" wheel provides additional wheel clearance and longer life.

DoALL D10 Grinders, with a new standard chuck size of 10" x 30", now offer work capacity and versatility not previously available in precision machines of this type. Either 10" or 14" wheels can be used.

Model D10 DoALL Grinder with coolant system and electric control panel.

Machine Filing Bulletins

An illustrated bulletin describing many advantages of DoALL Bench and Band Filers for faster, more accurate tool and die filing is available upon request.

New Grinder Catalog

A new 20-page illustrated catalog explaining the advantages, design features and accessories available for new DoALL Grinders has just been issued. Specifications data is included. Copies are available upon request.

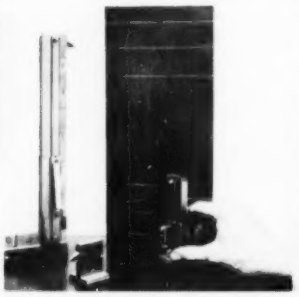
—— See Next Page ——→

GAGE BLOCKS TAKEN OUT OF "MOTHBALLS"

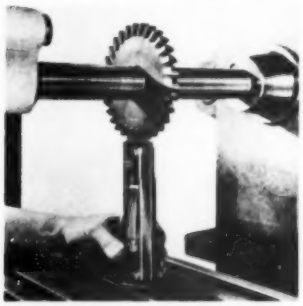
Now Put to Use for Toolroom and Production Gaging

Indicating comparator for production checking of mass produced parts.

Large indicating snap gage incorporating pre-calibrated dial indicator.



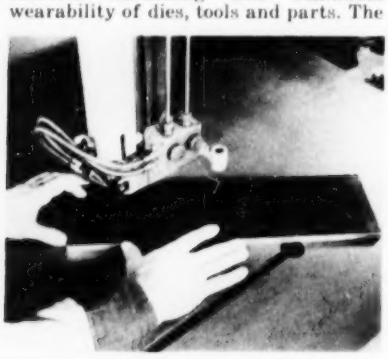
Straight line scribing done with new DoALL Micro-Step Gage Block setup.



Setting milling cutter. A carbide wear block is used to protect the gage.

Use of DoALL Tool Steel Insures Uniformity, Wearability of Tools, Dies, Parts at Low Cost

DoALL precision ground flat stock is a *controlled quality* oil hardening tool steel which provides easy machining, uniform hardening and maximum wearability of dies, tools and parts. The



range of 238 standard sizes, plus availability of special sizes, makes possible substantial savings in tool steel and machining time.

As illustrated, the procedure in using DoALL flat stock is to ink it, lay it out and contour saw it. Subsequent filing, grinding or other machining operations are dependent upon the part being made.

DoALL tool steel is carried in stock by DoALL Stores for prompt delivery. Detailed information is available in a bulletin, free on request.

Educational Programs

Upon request, the DoALL organization will present educational programs on band machining, surface grinding or precision gaging for technical societies, schools and plant groups.

Gage-Block Gages Quickly Assembled with New DoALL Micro-Step Gaging System

A new Micro-Step Gaging System, developed by DoALL, has taken gage blocks out of "mothballs", released them from captivity as the "jewels" of the inspection department, and put them to work in *direct* measurement of parts and machine settings in the toolroom and shop. For the first time, industry can fully utilize the millionths accuracy of these "measurement masters" to reduce errors, speed up gaging and eliminate the high cost of many special gages. Now gage blocks can be used practically and profitably as working tools. Gone is the day of keeping them under lock and key where their value and usefulness lay dormant most of the time. On the basis that idle tools make no money, DoALL has developed a method of creating dividends on gage block investments.

Essentially, the new System provides a means of quickly assembling an infinite variety of gages and layout scribers incorporating standard rectangular (USA type) gage blocks. These precision *gage-block gages* are then used for direct measurement. Typical instruments which can be assembled include indicating comparators, snap gages, go and no-go gages, internal gages, pin gages, depth gages, various scribers and many others.

Components

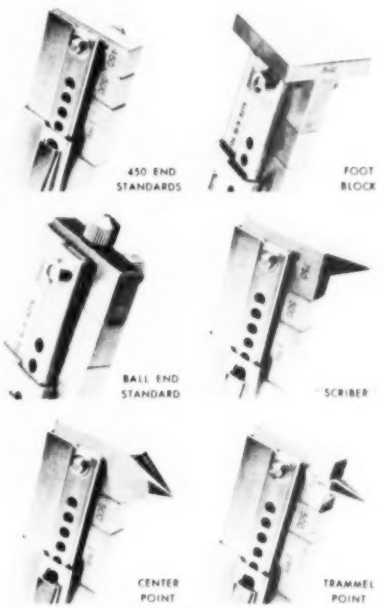
The components of the Micro-Step System are:

1. **Holders**—channel type for holding gage blocks in heights up to 72" or more; a unique caliper holder for setups to 6" is ideal for making outside and inside calipers, dividers, scribing compasses and others.

2. **Fully Exposed End Standards**—specially designed functional gage blocks provide the actual measuring surfaces of the assembled gage. The *unobstructed* surfaces extend beyond the ends of the holder, permitting innumerable setups never before possible with gage blocks in holders.

3. **Pre-calibrating Dial Indicators**—for making indicating *gage-block gages*.

4. **Gage Blocks**—DoALL, or any standard USA type.



Some of the Micro-Step End Standards available.

Wear Minimized

The design of the Micro-Step Gaging System prevents excessive wear of the gage blocks themselves. The blocks are not subjected to the sliding, wear-producing action of manual wringing, but are wrung together by moderate pressure of the holder clamps. Nor are they subjected to damaging contact with the part being measured.

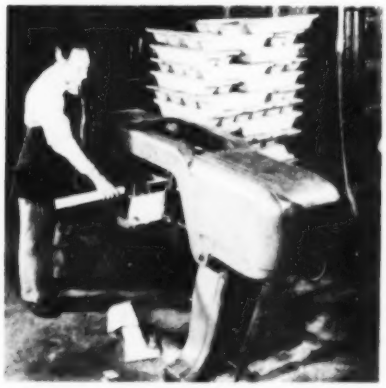
Complete information regarding the DoALL Micro-Step Gaging System has been incorporated in a new Bulletin available upon request.

Saves 5 Man-Hours Per Day With DoALL Claw Tooth Saw Band

Runs Johnson Cut-off Saw at Top Speed; Blades Last 3 Times Longer

Schauer Mfg. Corp., Rossmoyne, Ohio, dramatically proved the importance of the "correct saw band, correctly applied" in cutting-off aluminum ingots on a Johnson Band Saw.

Operating the machine at its mid-speed No. 2 step pulley with a skip tooth saw band, Schauer was cutting 6"



square aluminum ingots in 11 minutes.

At the recommendation of a DoALL Sales-Service man, they changed over to a DoALL Claw Tooth Saw Band and use of DoALL "Tool-Saver" stick lubricant, with these results: machine was stepped up to full speed; cut-off time was reduced to 2½ minutes; 5 man-hours per day were saved, and saw band life was tripled.

The DoALL Claw Tooth Saw Band has hardened, positive rake angle teeth and a flexible back. The design causes the teeth to literally pull themselves into the work, hogging through many materials with amazing speed. A bulletin on this band is available upon request.

DoALL Men Offer Helpful Services

DoALL Sales-Service Men are factory trained to help customers on sawing, grinding, gaging and metal cutting problems. Selection of the right band tool, grinding wheel or gage for the job, machine adjustments, recommended feeds and speeds are but a few of the ways they can assist. They are backed by DoALL factory and laboratory facilities to help customers secure maximum operating efficiencies.

Western Metal Show

The Western Metal Exposition will be held in Los Angeles, March 23-27. DoALL will exhibit at Booth 152.

Band Machining Effects Savings in Steel Tank Production

Contour and Cut-off Sawing 5 to 15 Times Faster With DoALL Contour-matic and Zephyr Machines

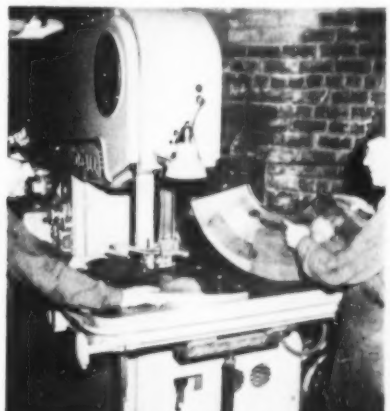
Table 1—Comparison DoALL Sawing with Previous Method

Job	Machine Used	Previous Sawing Time	Present Sawing Time
Cut-off 2¼ O.D. boiler tubes	Zephyr	3 minutes	7 seconds
Contour saw 16 gage black hot rolled iron	Zephyr	1 minute and 15 seconds	5 seconds
Production runs cutting off ½" O.D. boiler tubing	Zephyr	32 hours	6 hours
General heavy work	Contour-matic	varying times	1/6 as much time

For a wide variety of sawing jobs, Brown Steel Tank Company, Minneapolis, Minnesota, finds that its DoALL Zephyr Band Machine reduces sawing time up to as much as 15 times over the previous machine used. As a companion to the Zephyr, a DoALL Contour-matic machine is found to offer great versatility and ease of operation on extensive contour sawing work. The accompanying photos show work on gasoline truck tanks.

Table 1 shows typical benefits derived from use of these two machines.

Cutting 2¼ O.D. boiler tubing on DoALL Zephyr in 1/25 the time formerly required on a previous band saw.



Sawing a 1½" thick section of a forming die on the DoALL Contour-matic.

DoALL Zephyr machines are designed for safe, high speed sawing up to 15,000 blade feet per minute. They are widely used for friction sawing. Single or variable speed models are built with throat capacities from 16" to 60".

The DoALL Contour-matic is generally regarded as industry's most versatile and useful band machine. With a speed range of 40 to 10,000 band feet per minute, it can saw, slice, hone, file, polish or grind any material. It incorporates hydraulic operation to reduce operator fatigue and speed up work. As an all-purpose or single purpose tool it has proved to be a time and money-saver wherever used.

DoALL Laboratories Offer Customer Service

Recommended techniques for sawing or precision grinding of any material are offered by DoALL Laboratories after undertaking tests of samples. Reports give customers complete data on machines, band tools or wheels, speeds, feeds, setups, fixtures and other factors required to secure the most efficient results. Rate of production and finish attainable are stated. All tests are run on commercial machines to that results can be duplicated in the shop.

To secure this DoALL Laboratory Service call the local DoALL Sales-Service Store.

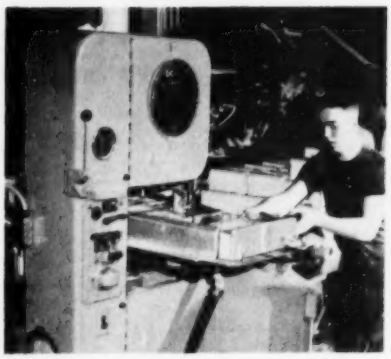
See Next Page

Printer Saws "Zane Grey's Western" on DoALL Zephyr Band Machine

Production men in metalworking plants are familiar with the short cuts that DoALL Band Machines make possible. It might surprise them to learn how high speed bandsawing saves production time in magazine printing.

The photo shows a DoALL Zephyr cutting stacks of Zane Grey's Western at Western Printing and Lithographing Co., Racine, Wisconsin. The magazines are printed and bound double for production efficiency. Here's what William L. Reisdorf, Bindery Foreman, says about use of the DoALL Zephyr for parting his "Siamese twins":

"We band saw 13 stacks of 12 books each per minute, or 18,720 books per hour, using a specially designed pusher type feeding device. The clay paper is very abrasive and heat generated causes the binding glue to melt at point of cut. These factors would greatly reduce saw band life. By installing a special blade oiling device, blade life is doubled, teeth don't load and objectionable dust is eliminated. We have a very efficient operation with a very satisfactory time saving over the method previously used."



Sawing double magazines in half with a DoALL Zephyr.

All DoALL Products May be Seen in "Action"

Demonstrations of DoALL equipment at any plant can be arranged simply by calling the nearest DoALL Sales-Service Store listed below.

New Deburring Stone Keeps Gage Blocks in Shape

In normal use, small burrs may be raised on the edge of gage blocks, interfering with their wringability and accuracy. The use of a DoALL Deburring Stone will restore the surface of a burred block to its original perfect condition. The block is simply rubbed firmly against the surface of the stone. When properly used, the dimensional accuracy of the block will not be disturbed, but the tiny burrs will be removed entirely. Details are available upon request.

DoALL deburring stone in use.

CALL DoALL locally at these Sales-Service Stores

ATLANTA 3, GA.
304 Decatur St., S.E.
Call DoALL: Walnut 5384

BALTIMORE 12, MD.
5621 York Rd.
Call DoALL: Hopkins 5340

BIRMINGHAM 4, ALA.
800 N. 24th St.
Call DoALL: Birmingham 3-0502

BROOKLINE 46, MASS.
89 Washington St.
Call DoALL: Longwood 6-9555

BUFFALO 23, N. Y.
1063 Kenmore Ave.
Call DoALL: Riverside 3424

CEDAR RAPIDS, IOWA
624 Fifth St., S.E.
Call DoALL: Cedar Rapids 3-0616

CHARLOTTE 2, N. C.
401 S. Mint St.
Call DoALL: Charlotte 4-2579

CHICAGO 39, ILL.
4650 W. Fullerton Ave.
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CINCINNATI 2, OHIO
536 Sycamore St.
Call DoALL: Main 3929

CLEVELAND 3, OHIO
6517 Euclid Ave.
Call DoALL: Henderson 2-1515

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1628 Industrial Blvd.
Call DoALL: Riverside 4536-37

DAYTON 4, OHIO
365 Vermont
Call DoALL: Michigan 2121

DENVER 4, COLO.
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Call DoALL: Alpine 7444

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15010 Plymouth Rd.
Call DoALL: Broadway 3-4141

GRAND RAPIDS 7, MICH.
410 Hall St., S.E.
Call DoALL: 5-2191

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45 Farmington Ave.
Call DoALL: Hartford 5-6664

HOUSTON 2, TEXAS
121 St. Emanuel
Call DoALL: Capital 6588

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1401-3 N. Illinois St.
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KANSAS CITY 6, MO.
1019 E. Truman Rd.
Call DoALL: Harrison 5857

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Call DoALL: Division 2-2950

MINNEAPOLIS 4, MINN.
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NASHVILLE, TENN.
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Calle de las Artes #48
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or Ericcson 18-63-74

Vol. 2—No. 1—62M—2-53

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yet, there are lots of people who, if they had another brain added to what they have got, they'd have one.

No, no paint for me. I don't like it.

F H Stebbins
Worcester, NY

•

DOUBLE STANDARD

Will one set of prints, with fixed tolerances, solve the problem of variations in tolerances between engineering, shop, and inspection? Or will allowances continue to be made despite a single standard?

AL'S GRIPE ABOUT double standards brings to mind several incidents that happened some years back that sort of tie up with some working tolerances and their problems.

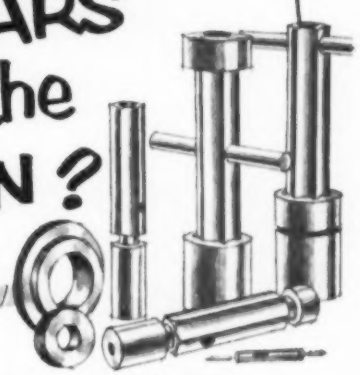
I appreciate the great value of close working tolerances and am inclined to favor absolute maintenance without any deviation whatsoever until the necessary changes are made through the proper channels. To me, a law is a law and should be upheld and adhered to until it is changed—whether it is just law or not.

My first encounter with difficulties brought about by manufacturing limits brought me face to face with the probabilities of the human elements interfering with the manufacture of the old eighteen-pounders back in '16. We had our own staff of shop inspectors and a bunch of Canadian checkers. On top of all we had, visiting us periodically, a dignified personage whom, for want of a better name, we'll call Major Plushbottom. The "Majaw" strutted into our busy shop with all the pomp and circumstances fitting one of his dignified status. The "Majaw's" moustache was an adornment sticking out each side of his ruddy face, like a couple of wiry Fuller brushes, waxed to the limit, and sheared with square ends—absolutely parallel to each other. He brought along a plug gage to be used for testing the inside bore of the shell; this was made up from a solid piece of tool steel and was hardened and ground, having a radius on the end slightly larger than the radius of the shell bore at the bottom.

"Now look heah!" commanded the major to his subordinates, "When you test for the boah you must let this drop in with a ring—try it a few times and you can heah it." Then the major went on to caution them about the danger of a tilt in the bottom.

To show you the inconsistencies

Are you throwing THOUSANDS OF DOLLARS into the SCRAP BIN?



You can now chrome plate worn gages *IN YOUR OWN SHOP*

This compact new chrome plating unit is saving real money for leading engineering and manufacturing concerns throughout the country. For instance, here's what Taller and Cooper, Inc., foremost makers of toll collection equipment and builders of electro-mechanical measuring and recording devices, say about their Chromaster installation:

"Within one hour from the time a space was arranged for the unit, the Chromaster was in operation. In the very first day over $100.00 worth of undersize plug gages that normally would have been discarded were replated and put back in use in our inspection department."

Same saving applies to other small tools

Normal life of your cutting tools and wear parts can be multiplied 3 to 10 times by this accurate, simplified method of chrome plating right in your own shop. Chromaster deposits chrome with positive uniformity yet the average job takes only 3½ minutes.

A Chromaster for every shop

Model A-20 (shown here) is a 20-amp. bench-mounted unit for the gage room or tool crib; plates up to 10 sq. in.

Model A-50, 50-amp. bench-mounted unit for larger shops in plating of cutting tools. Plates up to 25 sq. in.

Model A-250, 250-amp. floor-mounted unit for production plating of small parts in greater quantities or larger parts with areas up to 125 sq. in.

Chromaster

Write for cost-cutting free information today!

Industrial Chrome Division
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Please send me complete information on Chromaster industrial chrome plating

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MORE for your Press Dollar...

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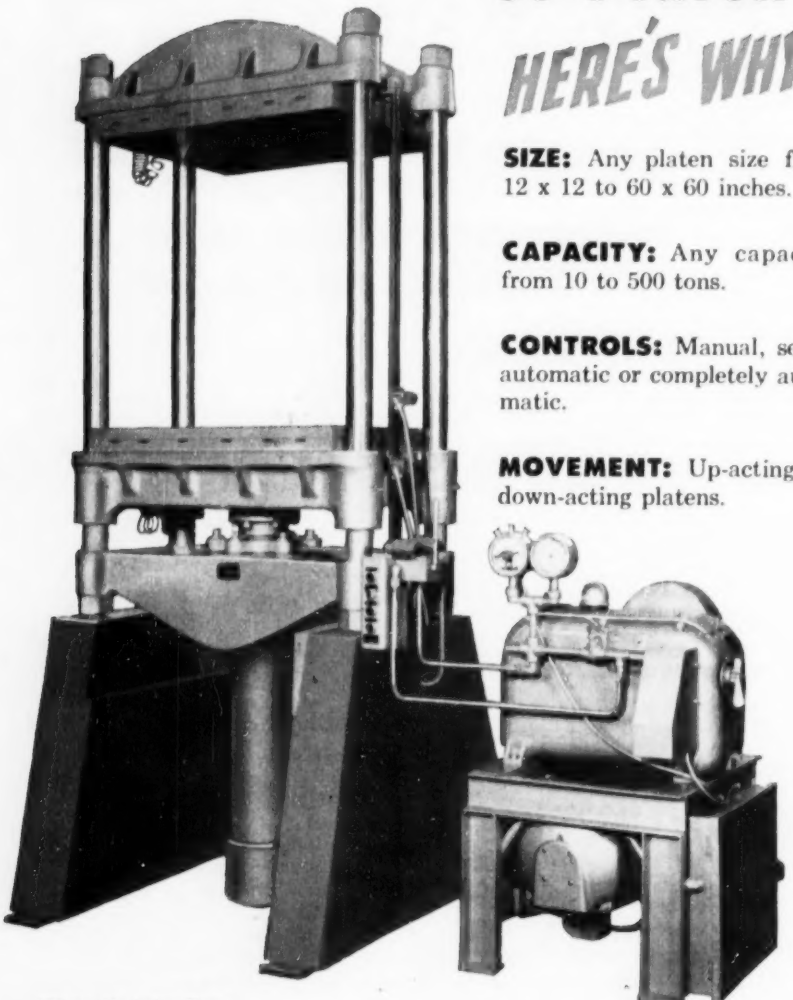

100 ton Up-Acting Platen Press with electrically heated platens—platen area 24 x 36 inches.

SIZE: Any platen size from 12 x 12 to 60 x 60 inches.

CAPACITY: Any capacity from 10 to 500 tons.

CONTROLS: Manual, semi-automatic or completely automatic.

MOVEMENT: Up-acting or down-acting platens.

PUMPS: Simple positive displacement hydraulic pumps or combination hydraulic pumps with various approach or return speeds.

PLATENS: High grade cast steel guided by heavy bronze bushings and ground and polished cold steel rods.

UTILITY: Select the press to best suit your needs in plastic molding, rubber molding, laminating, metal forming or shaping; also special presses for die tryouts and other utility operations.

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Rodgers Hydraulic, Inc.

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attendant on productive limits in earlier years, must say that we were held down pretty tight until the day came when any shell, no matter if it looked like a cockeyed gourd or a rheumatic banana, was badly needed at the front to stem the advances of the enemy. I recall the British inspector, who towered above the "Majah" in influence, whenever there was any variation in the thickness of the shell walls, would storm, "Do you want to kill off your own bloody infantry?" About six months following that outburst he gave orders to pass anything in order to stem the tide.

Ah, those were the good old days! And how about the days when the old boss approached you with a job and said, "Bore this out a shade over three inches." We've come a long way from a "shade" to 3" −0.000 +0.0001.

J Homewood
Ontario, Calif

•

IN MY OPINION tolerances should be set only after the engineering department, inspection, and the shopmen directly responsible for production have gone over them thoroughly, and satisfied themselves that the parts produced to their specifications will be machined at the minimum of cost, yet operate with maximum efficiency. When a true balance has been achieved between these desirable factors, then those limits of tolerance should be clearly stated on the blueprint and rigidly observed by shopman and inspector.

I believe the so-called psychology technique of tightening up tolerances, so that when the part involved reached assembly it would measure up to the engineer's specifications, had its origin when methods and machines were far from what they are today. With the advent of better tools and gaging equipment, tolerances can and are being held to limits of accuracy undreamed of even twenty years ago.

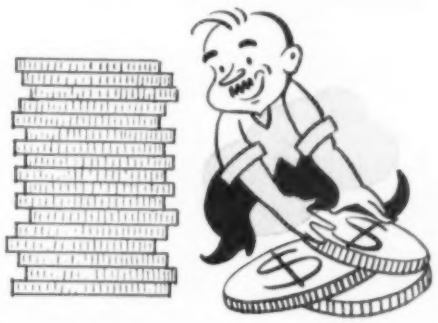
Of course, not every shop is in a position to lay out money for the very latest in gaging equipment, nor is it necessary to do so. The simpler precision tools, such as micrometers, verniers, and go and no-go gages can be depended upon to keep production moving and spoilage at a minimum, provided a careful check is kept on them.

As an added safeguard, the comparatively recent idea of in-process inspection has done much to make the double-standard psychology obsolete. In some shops it is common practice to assign one or more of the

Savings reported by users of LINCOLN PARK CARBIDE GAGES

An eastern manufacturer of ground glass products found replacement costs of worn steel gages to be excessive—gages were expended at a rate of 2,500 per year. At $3.50 per gage his annual cost for steel gages was $8,750.00.

Carbide gages were applied to this inspection operation and lasted at least 25 times longer than previous steel gages. After making a complete switch to carbide only 100 gages at $22.00 each were purchased per year. Thus, carbide gages cost only $2,200.00 annually and this manufacturer saved $6,550.00 each and every year on gage replacement costs alone.



For further information on how to reduce inspection costs with carbide gages, send for booklet . . . "If steel gages were *FREE!*"

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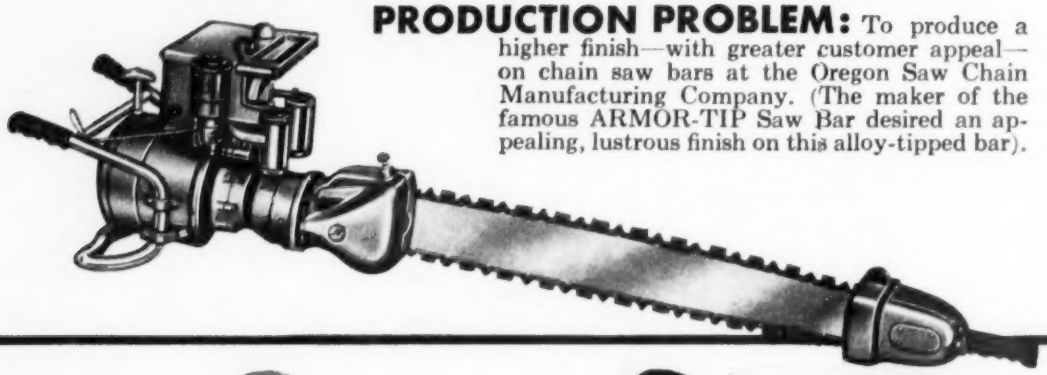
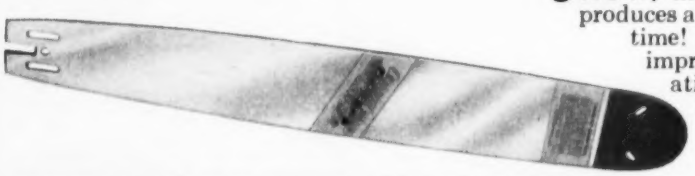
PRODUCTION PROBLEM: To produce a higher finish—with greater customer appeal—on chain saw bars at the Oregon Saw Chain Manufacturing Company. (The maker of the famous ARMOR-TIP Saw Bar desired an appealing, lustrous finish on this alloy-tipped bar).



1 A 3M REPRESENTATIVE analyzed the finishing operation and demonstrated how the 3M Backstand Method, using Three-M-ite Cloth Belts, would produce a better finish on the alloy tip than was achieved with a grinding wheel alone.

2 3M ALSO RECOMMENDED the right 3M Abrasive Belt on their Curtis Straight-O-Matic Grinder for final finish on saw bar surface. Previously, manufacturer had used a surface grinder for this operation.

3 NOW, this Portland, Oregon manufacturer produces a finer, more attractive finish in less time! Perhaps a 3M Representative can improve *your* company's finishing operations. His training and experience in industrial application of coated abrasives are available without cost or obligation.



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older workers to check work as it comes from the machine, as well as keep an eye on the condition of the gages. This method has a number of advantages that must be obvious, such as catching a mistake at its source before the machine completes its run of pieces, or the operator finds out his mistake. In some cases in-process inspection eliminates the need for final inspection with resultant savings all around, both in time and money.

There are human values involved also, which we cannot afford to overlook. We hear a lot today about utilizing the services of the older worker, the employee who has borne the burden and heat of the day on the production line. When he begins to slow up—as all humans do eventually—what better use for his years of experience and know-how could be found than in putting it to work in this form of quality control?

As I see it, quality—in the form of accuracy—begins in the shop. Given the necessary tools and men to produce that accuracy, and blueprints to work to that clearly state the dimensions that must be held to achieve a quality product, there should be no need for a double standard so far as tolerances are concerned.

Robert S Alexander
Greenville, RI

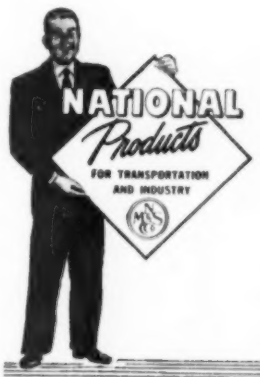
•

THE IDEA OF HAVING tighter tolerances than actually necessary, as a means of influencing other departments, seems to be the impression of some as a master stroke in psychology. This appears to be a silly conception of sound manufacturing procedure, but then we are in a silly world.

Although there are some instances where tolerances are made unusually severe, and far beyond the comprehension of practical-minded individuals, one will usually find that they are thought out pretty well as they should be.

When it comes to influencing people, we can see this practice exercised in other walks of life. Seems to me that it had been practiced long before the word psychology entered the layman's vocabulary. The first encounter I had with influence was as a youngster in my old shoe store at Third and Market where, as a cash boy and shoe shine, I had occasion to note its deceptive practice. Ever try to pull the wool over a woman's eyes? Well, if you haven't, just try to fit her to a pair of shoes! When she says that she wears a 5-A either give her a 5-A and let her suffer or, if you are hep to the ways

Castings by National
selected for Quality and Dependability



Products bearing these familiar trademarks have all established enviable reputations for quality and dependability. And to guard product reputations, these manufacturers *continue* to specify castings by National —one of the Nation's largest founders.

National's unparalleled experience in producing malleable, heat-treated malleable, and steel castings is at your disposal. Sales offices and engineering facilities are located at all five strategically located plants.

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A 16mm technicolor film. Narrated by Edwin C. Hill, this 27-minute film tells how malleable iron is made . . . tested . . . used . . . how its production economy, ductility, machinability, toughness will give you a better finished product. Available for group showings.

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Backstand Belts save 2 hours per day!

Armour Backstand Belts save 2 full hours per operator per day for steel tube company*

In removing burrs and grip marks from steel tubing, a well-known company* found they saved more than just the two hours per day operators had been given to make set-up wheels. Backstand belts outlast 4 to 5 set-up wheels—and without dressing they remain flat and true. And backstand belts give a better finish, due to their uniform grit.

Belts are only one of the many forms of Armour coated abrasives. There are more than 30,000 different varieties in grit size, backing, etc. We have sheets, discs, rolls, tubes—and specialties to meet your specifications. Your industrial supply distributor will tell you about this complete line. Call him today!

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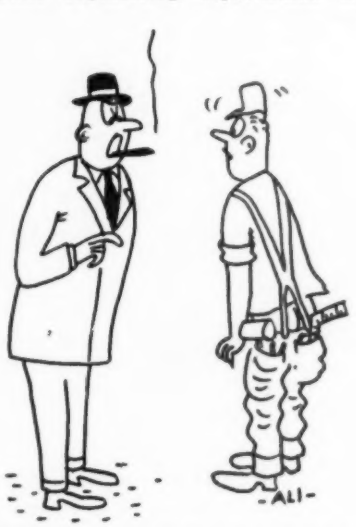
A

of women, slip on a 6-B and send her on her way in a happy frame of mind. What if you did lie to her until you were blue in the face—it won't be recorded in the book because you made someone happy in doing it!

"What's this got to do with manufacturing limits," did I hear someone say? Just an analogy in which the inspection department slips over a 6-B instead of a 5-A and the production saboteurs go away happy with singing feet. The engineering department, on the other hand, has a purpose in sticking to rigid limits in its specifications because it knows the weakness of human nature and, like the salesman who bamboozles the woman into a feeling of satisfaction, makes the other departments feel that it is necessary to maintain prescribed limits even though they might rebel in their own hearts at being tied down to seemingly impractical dimensions.

There is something to repression. Repression in manufacturing seems fraught with hindrance to production, yet, production without quality is worse. However, one must hold the reins pretty tight or the old nag will make a dash for the barn. There must be a certain amount of restraint—not productive restraint—or manufacturing limits will spread to the four winds because of the tendency of many to get by with good enough. I recall an old shop friend who said that "Good enough ain't good enough; it's got to be just zo—rrrrright on der button." Now there's close limits for you.

I have often become incensed at the seeming preposterousness of some engineering departments in



"Hereafter carry your tools in a tool box. Some of the wimmin workers are complaining."

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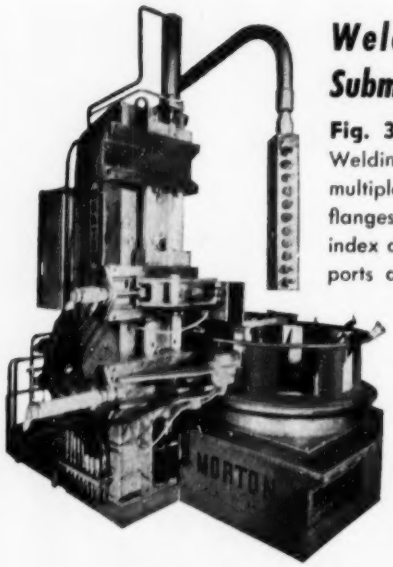
MORTON

DRAW-CUT

MACHINE TOOLS and SPECIAL MACHINERY



Welding Machines for Submerged and Inert Arc

Fig. 3065—Special Horizontal Index Welding Machine designed to weld multiple jet burner plate eyelet flanges. An eight station hydraulic index driving a 42" Rotary Table supports and positions the base fixture. The entire machine is fully interlocked to protect against accidental or improper operational sequence. All machine operations are pendant station controlled. Send for Bulletin No. 43-D covering Morton Girth Welding Machines.

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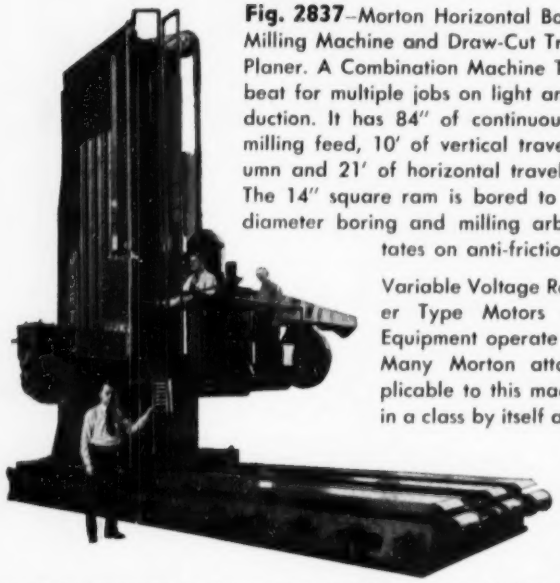

Fig. 2837—Morton Horizontal Boring, Drilling, Milling Machine and Draw-Cut Traveling Head Planer. A Combination Machine Tool you can't beat for multiple jobs on light and heavy production. It has 84" of continuous boring and milling feed, 10' of vertical travel on the column and 21' of horizontal travel on the bed. The 14" square ram is bored to receive a 7" diameter boring and milling arbor which rotates on anti-friction bearings.

Variable Voltage Reversing Planer Type Motors and Control Equipment operate this machine. Many Morton attachments applicable to this machine place it in a class by itself as far superior to other types of boring and milling equipment. Send for Bulletin No. 37-D showing this machine.

•

MORTON FINISHED MACHINE KEYS & SPECIAL SHAPES. Machine Tool Precision is Processed into Each Key. GIB HEAD—PLAIN—FEATHER KEYS—Bulletin 15-D. "HI-PRO" High Production Keys—Bulletin 24-D.

MORTON MANUFACTURING COMPANY

BROADWAY & HOYT, MUSKEGON HEIGHTS, MICHIGAN

their specifications, and could not help but feel that they had a definite purpose in trying to hold us down so close. I have felt that they were trying to prevent the team from running away in their eagerness to get going. We are all aware of the constructive value of striving to maintain a high standard. We may not be able to reach it conveniently, but there is something to hitching your wagon to a star, even though it is quite a stretch.

It is necessary for all to agree as to which is the best, rather than to leave the decision to everyone along the line. The viewpoint of the shop man should be taken into consideration when determining the proper dimensions. To leave him out is fatal, as he invariably knows where to cut corners. Theoretical limits are all very fine, but those limits must be such as to maintain the quality of the product, to facilitate the proper degree of interchangeability, and at the same time be such as to enable the parts to be produced at the lowest possible cost. If we are going to have the engineering department establish one thing, and then have the inspection people relax in maintaining them, we have no reliable foundation upon which to build an ideal condition of manufacture.

I feel that there should be periodical conferences in which all parties concerned would attend and contribute to these essentials and arrive at something definite and concrete. In this way theory and practice, working hand in hand, will arrive at a consistent working standard to which all can adhere. And when I say adhere I mean "stick."

Jack Everett
San Francisco, Calif

•

THERE IS NO more justification for double standard in a machine shop than in any other human activity.

It is unfortunately true that many tolerances are set without much thought being given to their influence on production and costs. Quite often they are set by a draftsman without shop experience, or an engineer who seems to think that the harder things are made for the shop, the better they are. No man should be allowed to set limits who has not had plenty of shop experience; still better, all tolerances should be adopted only after discussion between the drafting room or engineer, the production foreman, and maybe the inspector.

Once tolerances are set they

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should be the same for all parties, and should be considered right unless proved otherwise. If anybody understands that +1/16 or +0.000001 means just that, and there is good reason for it, and that all parts off limits are scrap, there will not be any tendency to ease off here and there to suit particular opinions.

Allowances for secondary operations, as mentioned by Al, for roughing, plating, etc, should be set at the same time and recorded accordingly. They all affect costs and should not be left dangling for individual guesses, whether they are educated or not.

It will simplify records, since the same drawings will be used by all departments. Tools, gages, can be duplicated without question since there is no deviation from public records.

Of course, all parties involved will have to be properly educated. It is unthinkable that so many book engineers try to establish standards which may have such an influence on costs as limits. No engineer is worthy of the responsibility unless he has spent at least a year working with his hands in the shop, and seen some of his work thrown out as junk because he has not followed drawings. (If the inspection department is on its toes, and spot check production, the loss should not have been great.)

Tools are somewhat different. Where they directly affect the tolerances, they should have closer limits than the drawing. Since only a few are made in comparison to production, the extra cost is not significant. Limits on other parts of tools could be amicably adjusted by the drafting and tool departments wherever it seems advisable, and records made accordingly, but again, once adopted, the limits should be final.

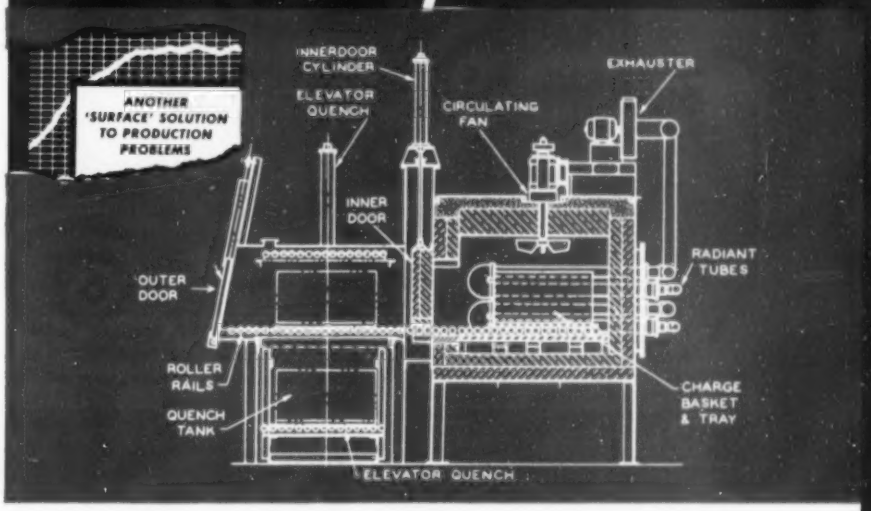
P P Fenaux
Lynn, Mass

•

ENGINEERING TOLERANCES and standards of finish are so important to the engineering manufacturing industry that it is difficult to understand why some firms treat them in so casual a manner. The effect of tolerances upon the end cost of a product can be so great that a revision of the figures on a drawing can result in a definite drop in production costs.

It is a well-known principle of interchangeable manufacture that a detail drawing for a component should give all the information necessary for its manufacture, and that a part made to this drawing should be capable of being assembled into a

'Surface'



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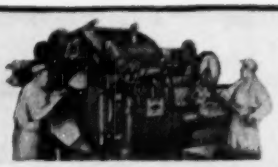

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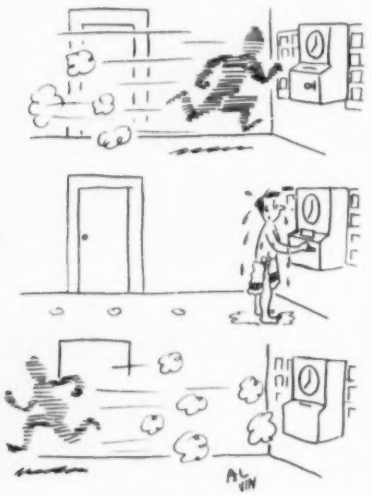
structure situated anywhere in the world. This is being accomplished every day of our lives in the automobile industry and by those firms who have to do subcontract machining of components. The secret of success in this work lies in properly-made drawings—drawings which tell the machinist everything he wants to know. If he has to ask one question while making the part, then, in my opinion, there is something wrong with the drawing.

Drawings that speak for themselves depend for their articulation on the draftsman who makes them. If he has little or nothing to say about the part he has drawn, due to ignorance, it is to be expected that queries will be raised in order to fill in the missing information. It is this raising of doubts which makes for differences of opinion between shop and inspection department as to the meaning or necessity of the tolerances specified.

No manufacturing organization — no matter how small, can afford to make drawings without tolerances. The idea of letting some person in the shop decide the degree of fit between machine parts is ridiculous and getting back to the methods used when George Stevenson built the first locomotive. Yet we all know that many tool shops operate on this knife-and-fork basis. Generally, the reason for such a way of working is that all the brains and know-how are concentrated on the shop floor, while the design department is staffed with slide-rule experts who could very likely design a gas turbine, but whose knowledge of machining is limited. So long as academic types of individuals are considered to be good design material, there will always be conflict between design and production.

The trouble seems to lie in the fact that all designers have their own



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private theories about tolerances with the result that each designer lays down his own tolerance system. There is no necessity for this, and top management should fight it and insist that one of the standard existing systems be adopted. One British system, the Newall, was laid down nearly 50 years ago and it is still a good one, in my opinion. It is compact, and the table to cover a wide range of work can be printed on a postal card. A comparison of this old system with that laid down for aircraft by the British Ministry of Aircraft Production during the war reveals close similarity.

Any draftsman who knows whether he wants a running, force, or press fit can lay down workable tolerances by reading them from a table of standard tolerances. Most of the accepted systems are backed by wide usage and carefully controlled laboratory tests. Any designer who thinks he can knock out a tolerance system of his own between breakfast and lunch had better think again of the brain work, expense, and experience that have been expended on some of the standard tolerance systems, and be duly humbled thereby.

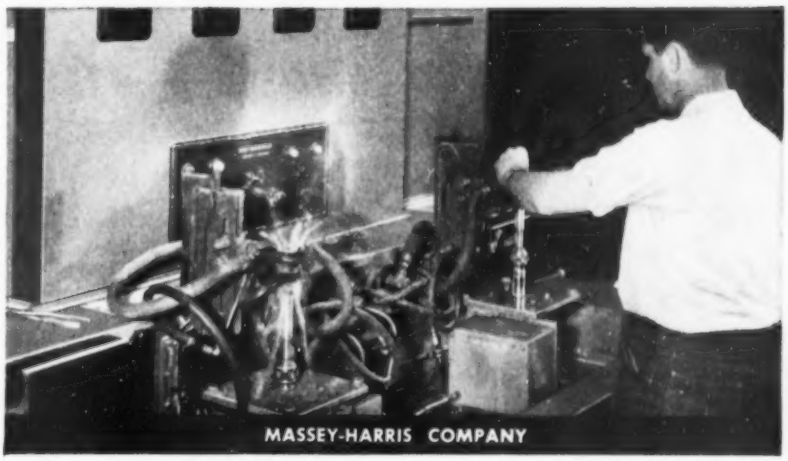
Having narrower tolerances for the shop and broader ones for inspection might seem to be a good idea. Unfortunately, it does not work out in practice, mainly because the inspection tolerances soon become public property and the shop loses respect for its own. I have no actual experience of the two-tolerance system, but I can imagine that the problem of segregating two entirely different sets of drawings, complete with tolerances, must produce a chaotic situation. In my experience, it is difficult to keep track of only one set of drawings, particularly when issuing new ones with modifications. Two sets would be a nightmare.

Respect for the drawing and its instructions is essential if any control is to be exercised over quality and manufacturing costs. The machinist must work to drawing. Once this has been put over he will be much happier, because if he obeys the instructions of the drawing, he is not to blame if anything goes wrong. If the drawing is not good, it must be modified so that it meets its function.

Tolerances are an important part of this information and if both inspection and shop work to the same drawing, the result will be greater cooperation between the two sections, instead of the antagonism which would result in two separate groups of tolerances being provided.

Clifford T Bower
London, England

Industries



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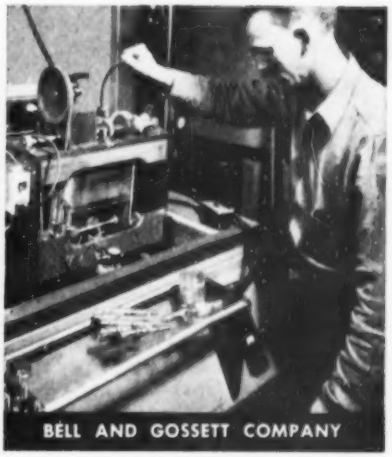

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STANDARDS IN MANUFACTURING processes are established as a means of quality control. To be charged with the responsibility of establishing the tolerances to control the quality of manufactured items is indeed a heavy one, and should be accepted accordingly.

Many factors enter into the setting of tolerances and limits, therefore anyone assuming this responsibility should have a sound, thorough understanding of the processes and equipment to be used to produce the item.

As in other phases of engineering work, handbook recommendations must be modified to suit actual conditions.

Who should have the final say in specifying the tolerances for a particular job depends upon who has the better understanding of the problem at hand—the designer or the shopman?

Usually, the designer refers to his handbook for recommendations as to tolerances and limits used on certain types of work, and unless he has had actual experience with the equipment to be used to produce the item, he may find that his limits of tolerance are economically unsound. If he should insist upon the last word, under these circumstances, the shop may have to put in more time to produce the item than would be necessary to produce it satisfactorily.

If the designer, after ascertaining the need and place for tolerance limits, would consult with the shop as to its ability to work to certain limits, the designer would then be nearer a real solution to his problems.

The responsibility for establishing tolerances should be a bilateral one,

"Just put yourself in my place, Mr. Hobson . . . or is that too unpleasant a thought?"

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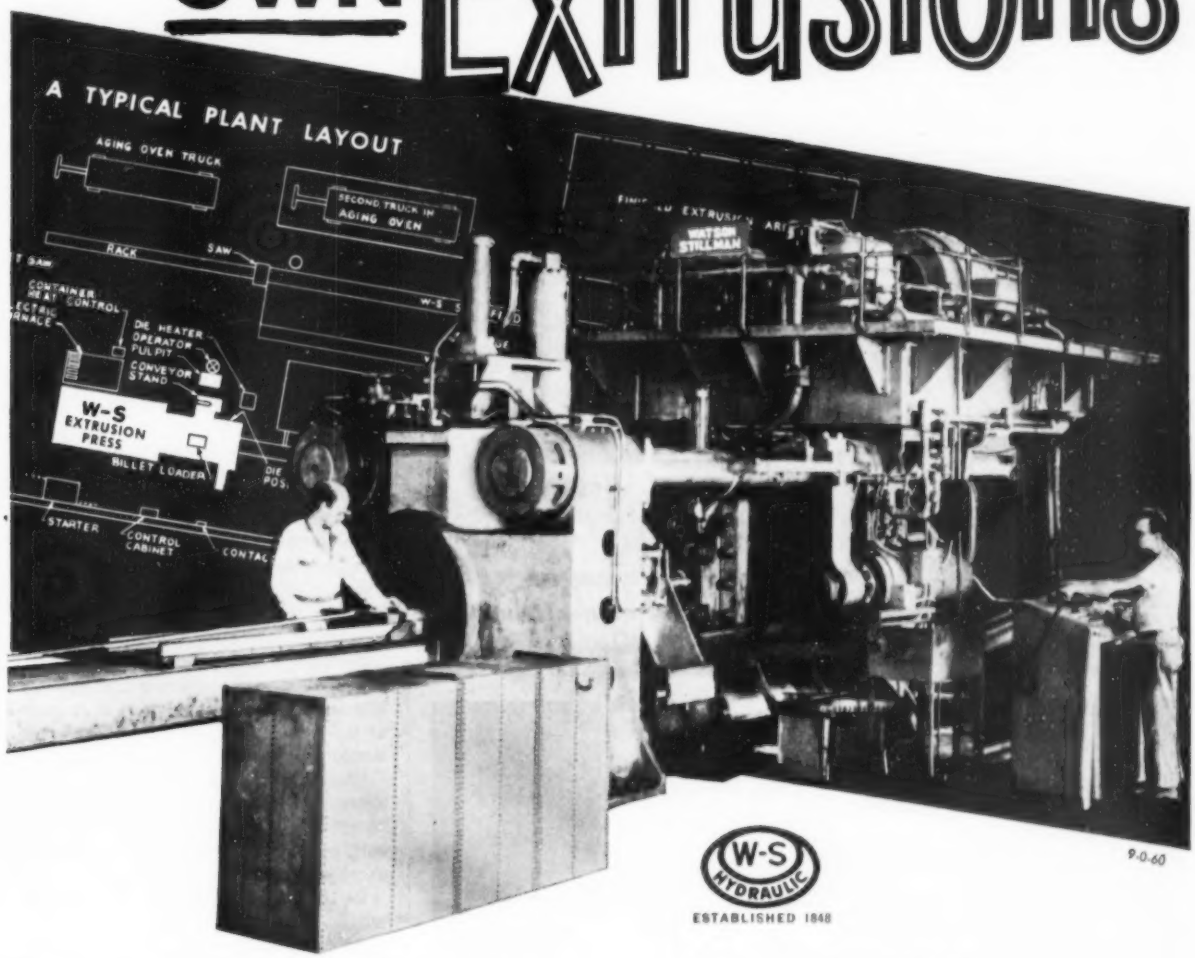

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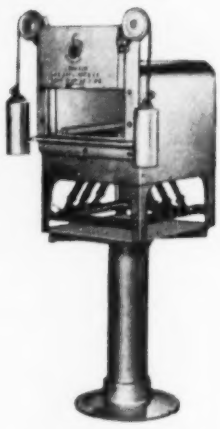

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in which the designer should be free and willing to consult with the shop, and the shop should be in a position to give the desired information needed to determine the most practical tolerances for the specific job.

Henry George
Dayton, Ohio

•

ANGLES — OR CURVES?

Is an employer justified in requiring a man to work overtime without ample warning? Can a worker justifiably refuse, if such emergencies are infrequent?

OVERTIME IS USUALLY a result of an emergency—something has happened in which no blame can be placed on anyone—or, lack of foresight caused by careless planning.

Breakdowns are distressing events that drop in unheralded and, in order that no unnecessary tieup occur in the production activities, must be overcome by unusual effort and sacrifice. Usually breakdowns call upon one or more to put in extra time—sometimes at a sacrifice. This sacrifice is generally compensated for in a small way by extra pay—such as time and a half. It is not always easy to find one who is willing to put in the extra time, and it is one of the causes for a foreman's loss of sleep.

Wouldn't it pay the foreman to know who appreciates the chance of getting some extra hours in, and call upon him whenever situations arise necessitating overtime?

In the old days before the quake, when we were paid time-and-a-quarter for overtime hours, I used to stack up a considerable pile of extra jack by way of the quarter-extra route. Many a night I "worked" until sunrise on some urgent job—taking out a few hours in the overhead storeroom, stretched out on a pile of colored waste, without bothering to stop to clock or reprimand an easy-going conscience. So you can't tell, Mr. Foreman, who you're running up against when you ask one to put in some overtime to help out in an emergency.

There is a certain amount of obligation one owes to his employer, and it will do him no harm to go the extra mile. Unselfish disregard for his interest by refusal to put himself out to meet a crisis will some day meet with a rebound when he is found wanting. Successful manufacturing calls for unselfish endeavor on the part of management and worker. This applies to all hourly-

paid employees or those working on a salary. The former are rewarded by an additional amount for overtime, whereas the salaried employee stores up treasures in heaven in the form of non-deductible leave of absence.

I had the shock of my life a few years back when working for one of the progressive firms in the Middle West. As a draftsman I put in considerable overtime while working on a salary. I though to myself, "Boy, they don't mind working a fellow to the limit on this job." Uncomplainingly I plugged away knowing the bread cast upon the water would soon return to me in the form of nourishing fish. At the conclusion of the emergency, the chief came to me and showed me a total of the extra hours I had worked and then informed me that I could have a vacation amounting in time to almost double the amount.

Come to think about it, that was a greater reward than time and a quarter with a pile of colored waste thrown in—at least I could live along with a clear conscience even though I did lose out on a little sleep!

Jack Everett
San Francisco, Calif

•

IN THE OLD DAYS, we worked ten to twelve hours a day without time and a half for overtime. During a breakdown, we would put in 20 to 30 hours. We were never asked to work overtime; it was part of the job. The men's wives and girl friends never knew if their dates were going to be kept. An employee who couldn't be depended upon to stay on the job after the whistle blew didn't last long.

There wasn't much for a man to do after work, so he didn't mind. His rate was low, and he had to put in time to get a reasonable paycheck. It was not rare for some plants to operate seven days a week during a rush season. I worked for two years on the night shift, from seven at night to seven in the morning, seven days a week, at straight time. When the shift was changed to eight hours, I had plenty of time to attend classes in engineering and in eight years, I received my degree.

Today, the men with their high wages and 40-hour working week haven't time for self-improvement or culture. With television, drive-ins, motor trips and a half dozen other diversified means of entertainment, they have a fulltime schedule. In fact, with some men, their work interferes with their social activities and they take time off to catch up.

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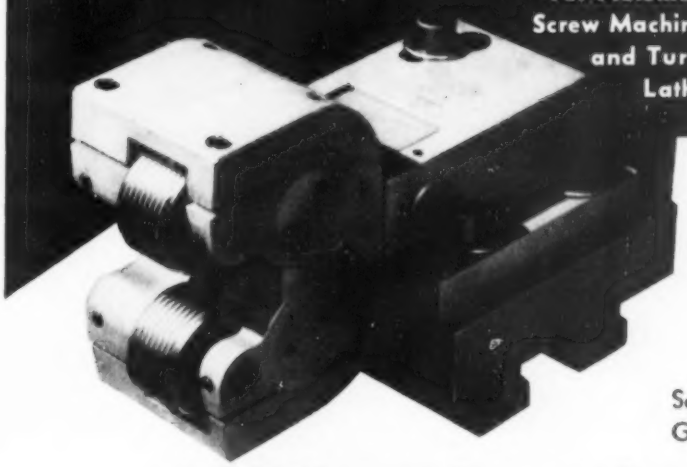
For Automatic Screw Machines and Turret Lathes



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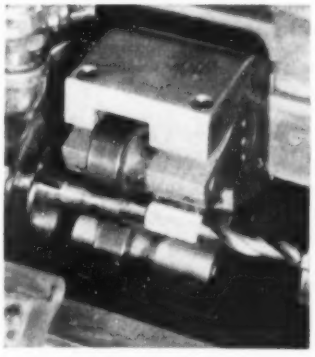

Reed attachments have two opposed rolls which pass over the work when rolling the thread. They are easy to set up and rolls may be quickly changed and adjusted for size. A simple device provides for precise matching of the rolls.

Thread rolling is accepted as an economical and preferred method of producing smooth precision threads on automatic screw machines and turret lathes at high production rates. It permits threading close to shoulders and since rolling can be done on the collet end of the part behind shoulders, a secondary threading operation is often eliminated.

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During the summer, Monday morning is part of their weekend.

There are many men who are always looking for overtime at their convenience. They won't work Wednesday or Friday, but will put in extra time on the nights they haven't anything to do. Since overtime is expensive and is used mostly as an emergency measure, the foreman likes to pick his best men for the job. Some of them can't make it that night, so he settles for the next best. The other men complain that they don't get overtime and give the foreman a hard time.

Frank J Zarnowski
Rutherford, NJ

•

MACHINERY CAN be made to operate at a certain speed and to do a specified operation continuously. However, humans are not made so, and are very much affected by their surroundings.

Many of them do not surrender to the will of their employers in all respects, although in regular routine work are very efficient and reliable.

I well remember one whose occasional song or outbursts of cheer and occasional jokes created a certain comfort in the department where he worked without lessening anyone's output.

There was an instance in the shop of which I was the foreman when one of the most capable men in the plant told me that he had engaged himself as foreman of a small shop that was just starting up, at a salary much beyond what he was getting at present or could possibly expect from his present employers.

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I expressed my regret that he was going to leave, and my wish for his success on the new job, and for these few remarks was criticized by higher authority.

He left in good spirits and very soon brought in jobs for us to do, as their small shop was very limited in equipment that could be used on their work. This went on for about two years; then he came in one day and stated that their work had fallen off to an extent that he now would be glad to come back on his original job and pay. I immediately accepted his offer and was heartily applauded for doing so by the higher authority that criticized my action at the time he left our employment.

I believe Al is right—times have changed. All angles should be carefully considered. There should exist between a foreman and a workman a friendliness and interest in each other that would make matters comfortable for both.

The cost of breaking in new employees is now the highest that it has ever been, therefore changes should be even more carefully considered. The reputation of an organization is made largely by the length of service of its employees.

The management in general has no way of knowing accurately how important it is to a worker to have interruptions in his spare time outside of shop working hours.

Of course each party concerned should give as much advance notice as possible of overtime needed.

H B Martin
Watervliet, NY

•

WHEN A MAN ACCEPTS a position in business, he agrees to work a certain number of hours for so much money a week. It is the same thing as signing a contract. If the agreement makes no mention of overtime, the employee is not compelled to do so.

If the employee has an important business engagement or a date with his best girl, we cannot force him to work overtime; some appointments cannot be broken at the last minute.

The foreman who fires the employee under these circumstances is making a mistake. The situation is somewhat different with salaried employees who are usually members of the staff. They are made to feel it is their duty to work whenever it is necessary.

I have never ordered a man to work overtime, but I have asked many employees if they would. Most

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employees know that if they get along with the boss they get along; and they are willing to take their regular turn.

It has been my experience that employees do not like to work over unless they are notified in advance. A good leader gives advance notice, or, if this is impossible, he explains the why and need. The supervisor who throws his weight around will find many headaches in trying to meet schedules with overtime.

When handing out overtime, it is customary to pick top seniority and then down the line. Although a man cannot be forced to work overtime, continuous refusal on his part gives the supervisor the right to deny this employee any overtime.

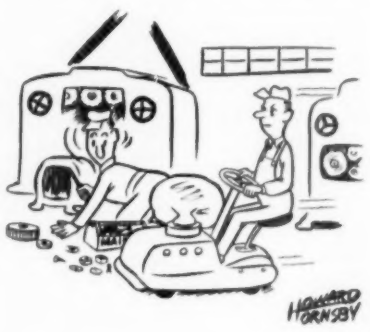
Cooperation is a two-way street and works both ways. We must recognize the rights of others even when it inconveniences us to do so, yet we must not be too easygoing in the interest of the firm.

A E Salmons
Philadelphia, Pa

•

IT IS A GOOD INDICATION that the human race is making progress when an employer may no longer demand that a man work overtime on five minutes' notice. Man must have leisure if he is to maintain a position higher in the social scale than is accorded to a beast of burden. Time was when men were asked to work hours that would have been cruelty to a horse; in fact, there was a period when the horse enjoyed greater consideration than man.

The arrangement between employer and employee is, admittedly, very loose and, while the civil law is quite clear about what a man may or may not do during his employment, I don't think that there are any firm regulations about when a man may withdraw his labor. His labor is all the asset he owns, and his right to withhold or sell it is still his one bargaining point. Any employer who tries to interfere with this basic human right by imposing



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STATION No. 3
VERTICAL UNIT
Comb. 15/16 drill & 1/16 x 45°. Chamfer 2 holes. Rough bore center bore 1 hole. Rough bore starter bore 1 hole.

STATION No. 4
VERTICAL UNIT
2 holes .438/.499 dia. ream
1 hole semi finish center bore
1 hole comb semi finish and finish starter bore
HORIZONTAL UNIT
8 holes ⅛ dia. & 90° chamfer

STATION No. 5
VERTICAL UNIT
2 holes ⅛ dia. x 90° chamfer
3 holes ½ dia. x 90° chamfer
2 holes spotface 1⅛ dia.
HORIZONTAL ANGLE UNIT
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3 holes 7/16—14 tap
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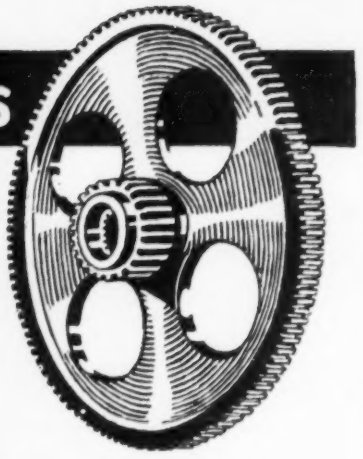

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unexpected "overtime—or else" is nibbling away at democratic liberties.

Unexpected calls for overtime are a sign of inefficient management which has never heard of forward planning. If management has heard about it, they have turned a deaf ear.

I have had my own share of sudden overtime demands and could attribute every one of them to inefficient management. What happens is that a firm, through greed, accepts more orders than it can meet in comfort and hopes that by muddling along it will meet the delivery date in time. The delivery promises made by such firms are not worth the breath taken to make them, and when the customer presses for delivery, it is a case for excessive overtime. In this democratic age, it is unjust that many should suffer for the rash and misguided promises made by one individual who is out of touch with modern management techniques.

Efficient forward planning and the amount of overtime to be worked are interdependent upon one another. The production plan works on a time base of machine and plant hours available and since the plan is made before even the material has been ordered, a firm prediction as to the number of hours of overtime required to meet the delivery date can be made. Few workmen will object to being informed that they will be expected to put in ten hours overtime every week, for four weeks, starting a month from now. A warning of this nature is fair and reasonable and any man who objects can take action to be excused or can look for another job.

It is highly probable that the work-

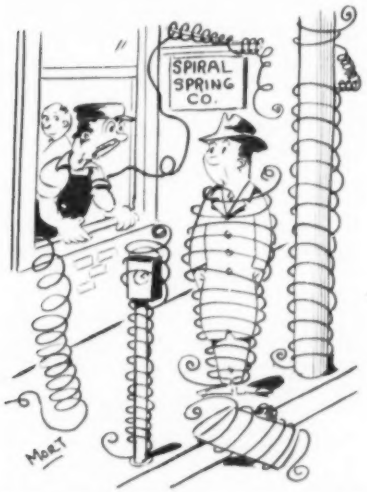
"Worst tobacco fiend I've ever known."

man has done a bit of forward planning of his own. He may be planning to use the summer evenings for painting his house, digging his garden or just lying in a hammock. Every one of a hundred men in a shop will have made similar plans. But one cockroach Napoleon in an executive position has made no plans. In consequence, the whole hundred men must suffer for one man's lack of foresight.

The 40-hour week is now a fact throughout North America and Great Britain. It is a fact, despite the outcries of a loud-voiced majority, because it represents the view of the majority. Backward employers who expect to chisel bits off the leisure time of the majority would do well to reflect that they are opposing majority opinion and cannot expect to get their own way without a public outcry.

The salaried employee who does not punch a time clock is expected to work overtime whenever he is requested to, without extra pay. He should be given the same consideration as the men employed by the hour and should not be subjected to unexpected demands. It is a fair practice of some firms to impose a limit on the amount of overtime for which the salaried man is expected to work without pay. After this period, the man is paid an hourly rate equal to 1½ time his average hourly pay.

Other firms have put staff, such as drawing-office employees and time clerks, on an hourly basis so that their pay is in direct proportion to the hours worked. This had been done at the request of the employees themselves, in many cases. It was once a standard practice to put



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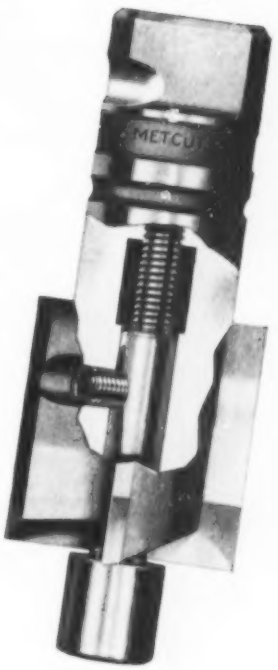

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draftsmen on salary and, before drawing-office work became a bottleneck, it worked out fairly advantageously to the draftsmen. They could take occasional days off without their wages suffering any drop. Since the war, draftsmen have been called upon to put in enormous hours of overtime and the fixed-salary man found he was working at laborer's rates when the hours were added up.

Since putting draftsmen on the time clock, some firms now realize for the first time in their existence just how much their drafting is costing. They are also getting some ideas about standard times for drawing-office work and these times help the accurate forward planning of drawing-office work enormously. Thus overtime can be predicted well ahead.

If overtime is predicted accurately, ahead of time, the response to the request will be 100% in favor, in most cases. With regard to an employer demanding overtime, I don't see that he has any rights in the matter. An agreement with the trade union would appear to be the best way for the employer to get some extra hours out of his men. Another way to do the thing in a business-like manner would be to make it a condition of employment before a man is hired that he will work overtime when requested. This means entering into contracts with the individual workers and may not be possible without infringing on established agreements with the unions.

Clifford T Bower
London, England

•

SOMETIMES A FOREMAN is placed in a very trying situation, often not of his own making, where the very best tactfulness on his part is called for to keep things on even keel.

The poor guy has no control of some conditions arising as they occasionally do—out of thin air. Obviously he is the one who has to meet these unforeseen emergencies and in order to do so he has to call upon the cooperation of his men. These emergency measures, oftimes making it necessary for one or more of his workers to be asked to put in some extra time, do come at a time when it is most inconvenient for someone to conform.

On the surface, it seems like an imposition for a foreman to ask one of his men to give up a previous engagement in order to accommodate an emergency. When the emergency has to be met, someone has to be

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Nash Motors changed from a hand torch to TOCCO Induction brazing of drain flanges to oil pans. Labor and material costs dropped from $12.75 to $4.90 per hundred—a cut of 60%. Hourly production more than tripled.
Norris-Thermador Corporation switched from arc welding to TOCCO Induction Brazing of this bushing and clamp assembly. Result: costs reduced from $46.44 to $31.73 per 1000 parts—a 32% saving.

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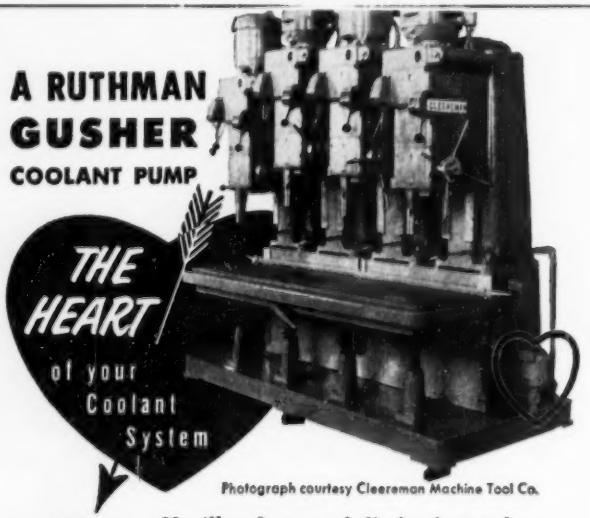

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put it to an inevitable inconvenience.

The question arises as to what is the most important—the inconvenience or the emergency? What is paramount, the worker's loyalty to his employer or his loyalty to his own independence? I should think that anyone who was asked to put in a little overtime, providing that it wasn't too much, should be considerate enough to accommodate, even though it did put him to a little inconvenience.

We cannot dictate to a man that he should work overtime any time that the boss sees fit to ask him. It is too much like handcuffing him to say upon hiring him that he should be available at any time he was needed.

The chances are that Mayberry would not have turned Ed down had his date with the poor man's Marilyn not been planned ahead of time. I know there were several times in my young and reckless life when no job could have held me from those blissful evenings with the fair sex. Come hell or high water, I would have sacrificed the smell of oil and hot bearings willingly for the delicate touch of Lux skin and a nostril tingling with crushed violets.

It isn't always the moon-struck young that the boss has to contend with. I went to one of my oldtimers once and said, "I want you to put in some overtime on that job; we've got to have the machine running before morning."

The guy smiled and informed me that he just couldn't do it. "We've got a party planned and the arrangements are all made for the gang."

Well, I was decidedly on the spot. I couldn't very well say, "To hell with the party; you'll have to stay on and get that job done." That wouldn't be right even though we

"That apprentice you sent me this morning —did it occur to you to have him recite the alphabet?"

were paying the men extra for putting in the time.

I suppose the inducement of extra pay for overtime was arranged so as to iron out these wrinkles caused by emergencies and personal inconveniences. There are times when a worker, just for pure cussedness, refuses to put himself out to meet an emergency. Just what to do with this type is up to the foreman.

Deliberate uncooperativeness may be met by some drastic move, such as a layoff or dismissal. A record may be kept of his conduct to serve as a black mark toward some future promotion. It's a certainty that no foreman is going to keep such a man on and let a more cooperative person suffer when the time comes to reform the ranks on account of slack periods. I feel that every consideration should be shown the worker who is asked to jump in at a moment's notice. He should be set up to a good meal and the company should stand the expense of a phone call even though it is long distance. The emergency to be met is the company's and the man should be shown some consideration for the inconvenience he has been put to do his part in meeting it.

J Homewood
Ontario, Calif

•

ALMOST UNIVERSALLY, we are prone to think of our good United States of America as an entirely free country, but is it? There is hardly an effort made by an individual or a company but what there is some regulation for it.

Thomas Jefferson once said, "That country is governed best which is governed least," and Tom was rather wise in more ways than one; the irony is that we have so few men of his caliber with us in these eventful days.

Al is handling a knotty problem with a man (Mayberry) who formerly wanted to try out our theory of democracy and one of the fundamental rights of Americans, that is, freedom to do as he wished at all times.

Al did act and must act according to his own lights, but it looks as if Ed has never learned that there is such a thing as freedom, or the theory of it, abroad in the world today. Perhaps it would not do any harm if both he and Mayberry were to take a day off and do a lot of straight thinking upon the subject of fair play to all. One of the freedoms of today is based on the theory that a man is at liberty to work whenever and wherever he may desire.

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A few minutes with a Warco representative is all you'll need to see why the added quality designed and built into Warco Presses guarantee extra life at lower maintenance costs. You'll be introduced to many features, exclusive with Warco, that spell added safety, less operator fatigue and greater press speeds.

Too, your Warco representative is a specialist who'll work with you in getting a press that will do the most efficient job per dollar invested. And, you'll appreciate, like hundreds of others, the johnny-on-the-spot after sale service for which Warco representatives are noted.

So, next time you think of presses be sure you have the Warco story — it will pay you in the long run. Warco representatives located in all principal cities.

Federal® WELDERS

THE FEDERAL MACHINE & WELDER COMPANY

WARREN, OHIO

Warco PRESSES®

Vinco is mass producing component parts for him

His full enjoyment of dinner at home is never spoiled by worries about component parts when Vinco is producing them. He knows the parts will be delivered as promised and will meet all specifications. This confidence is reflected by manufacturers throughout the metal working industry. As a result, Vinco has been forced to expand its production facilities. The next time you have parts to be machined to loose or close tolerances, call Vinco.

VINCO CORPORATION
9125 Schaefer Hwy.
Detroit 28, Mich.

SPLINE GAGES

GEARS

GEAR PUMPS

Formed Wheel Dressers, Automotive Cam Checkers, Optical Dividing Heads, Precisiondexes

VINCO

MILLIONTHS OF AN INCH FOR SALE

THE TRADEMARK OF DEPENDABILITY

Now, to return to the shop. A man is usually hired to work a certain number of hours per day, and for this he is paid so much per hour for the agreed number of hours.

During these hours, his time belongs to employers; he should not only give his time, but the best work he can do both mentally and physically.

Probably Mayberry had proven himself to be a first-class mechanic when he was in the shop previously, and worked the regular hours. But, when he was asked to work overtime, hours which he considered to be his, he kicked over the traces. To him, Ed had attempted to take away his freedom.

Generally speaking, men are glad to have the opportunity of working overtime becouse the extra money will fatten the pay check or the envelope, as the case may be.

Many a man has worked several hours overtime per week, but, if this is carried to excess, he is very apt to reach a state where his health will not stand such a siege and he has to take sick-time. Such acts as this take away the profits or extra money made by working such long periods.

On many occasions, within an hour of quitting time a man is asked to work overtime that night; should he be censured if he declines, because he has an engagement made several days previously?

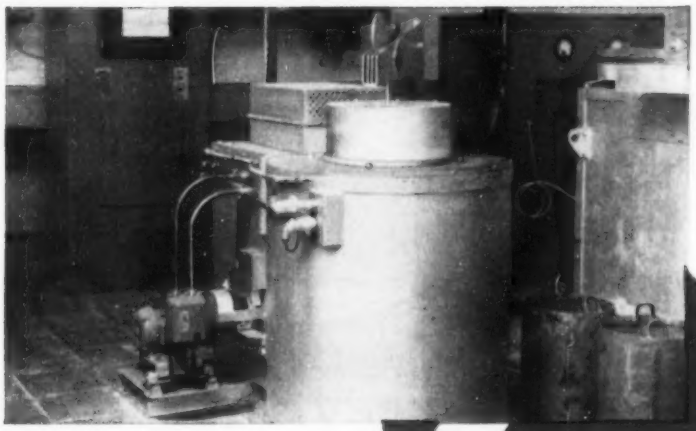
No, for here again our freedom comes into play; it may be that the man has some other very definite reason for not wishing to work.

In one case where a mechanic kept his own business well covered, there was a discussion something like this:

Foreman: "Jake, how many teeth will you have to cut in that gearwheel to finish the job?"

Jake: "Forty-two, I think." (the gear had 318 teeth)

"Got it for a buck. The stores are clearing 'Em out since Ike wore that Homburg for the Inauguration."



LINDBERG IN *France*

La Compagnie Singer in Paris is but one of the many manufacturers throughout the world who use Lindberg heat treating furnaces. At the Singer plant, high speed tools are hardened in Lindberg "Hydryzing" furnaces*. And tempering is handled in Lindberg "Cyclone" tempering furnaces*.. utilizing the famous forced convection heating principle. For details and "case history" information contact your nearest Lindberg representative.

*Built under license by Etablissements Jean Aube, Paris, France.

LINDBERG FURNACES

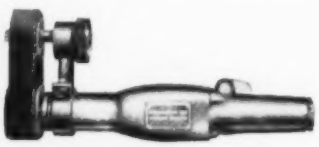
LINDBERG ENGINEERING COMPANY
2445 West Hubbard Street, Chicago 12, Illinois

TWO NEW BUCKEYE
Belt Grinding Attachments
FOR CLOSE QUARTER WORK

Now—you can save up to 50% on grinding costs, even on close quarter work where every inch of free space counts! These two NEW Buckeye Belt Grinding Attachments are specifically designed for grinding on concave contours and confined areas.

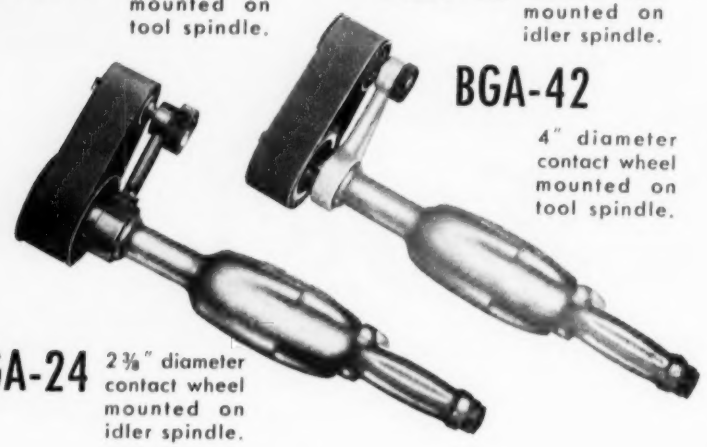
The BGA-12 and BGA-24 models provide the same economy, efficiency and fine finish as the standard BGA-21 and BGA-42 models, PLUS extra maneuverability for working in close quarters. Choose now from four models . . . select the Buckeye BGA that meets your grinding requirements exactly.

BGA-21 2" diameter contact wheel mounted on tool spindle.



BGA-12 2" diameter contact wheel mounted on idler spindle.

BGA-42 4" diameter contact wheel mounted on tool spindle.



BGA-24 2⅜" diameter contact wheel mounted on idler spindle.

• what are you waiting for?

In just two minutes, you can write for Bulletin S-13 and get complete information on all four models, any one of which can help you cut production time and costs.

Buckeye Tools CORPORATION
DIVISION 15 • DAYTON 1, OHIO

Portable Air and Electric Tools for Industry

IN CANADA: Joy Manufacturing Co. (Canada) Ltd., Galt, Ontario

Foreman: "That's what I knew, and if you stay until twelve, we won't be hung up. It's a rush job."

Jake: "Well, you see, I am going to get married this evening."

Foreman: "Wh-a-a-t? Who said so?"

Jake: "I said so, and it cannot be put off. Can you blame me for not working that overtime?"

Foreman: "No, and I'll finish your gear or have one of the other boys work on it. There's Charley; he's always wanted to work on that big machine you're on. We've got to have the gear pronto."

Within that last hour, the men in the shop made up a purse for Jake, and the foreman presented it to him.

Isn't this a better ending by far for an affair of this kind than to have Ed tell a man that he must work overtime or else?

F H Stebbins
Worcester, NY

•

BAIT FOR SPEED

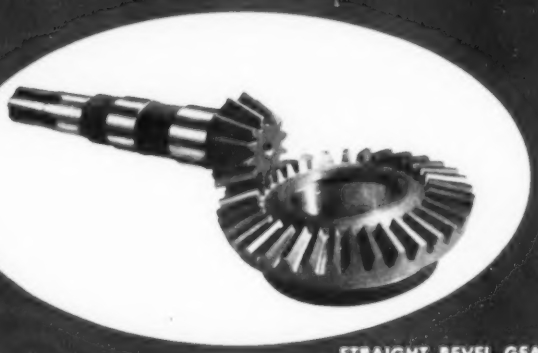
To SPEED UP and meet schedules on rush jobs, the boss employs different methods of leadership. Leadership is an art that requires different methods according to the circumstances.

I do not believe in the push, coax, cuss, or threat idea of getting out rush jobs. This turkey dinner is the coax idea. Once given, the employees will expect it every time a rush order comes up. We must not only consider one rush job, but all urgent orders.

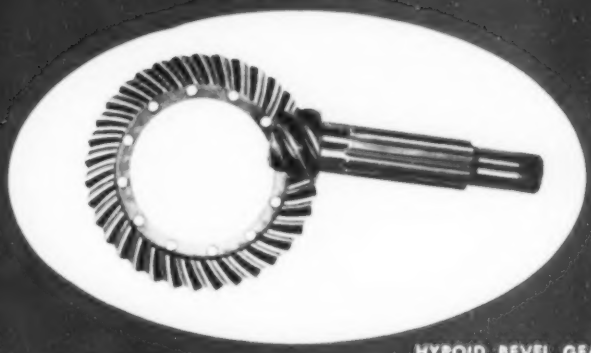
In my opinion the best method to secure cooperation of the workers to meet schedules on rush orders is to take them into your confidence. They should be told who the job is for and why it is so important. With a self-confident, it-can-be-done attitude, the foreman inspires enthusiasm. This is a good way to get the employees with you as a team. The whole team knows what is going on, and they know when something special comes up. They then feel they become a part of the enterprise. They like that feeling of importance.

It is the best way I know to make the employees happy to do the job in the fastest and most efficient way. It is the harness of pull-together, efficient accomplishment. It has nothing to do with over indulgence. When once we give the workers this feeling of importance we can lay down a challenge or tell the boys what is expected of them, democratic management will win out.

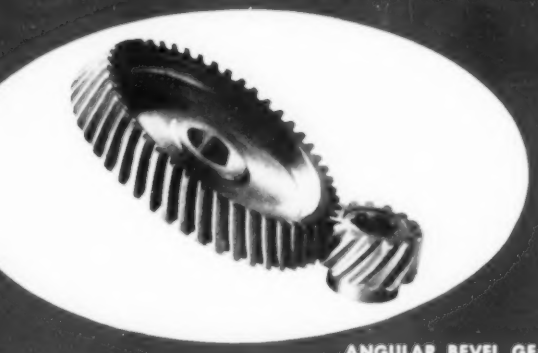
A E Salmons
Philadelphia, Pa



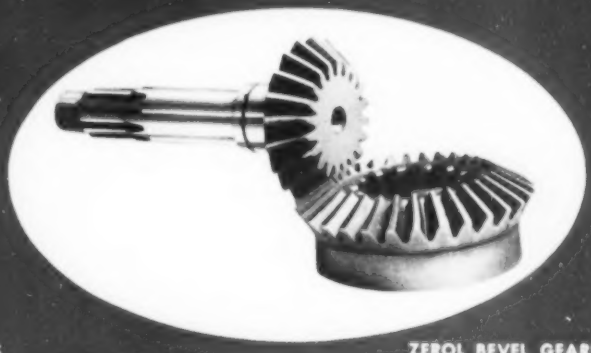
STRAIGHT BEVEL GEARS



HYPOID BEVEL GEARS



ANGULAR BEVEL GEARS



ZEROL BEVEL GEARS

SPIRAL BEVEL GEARS

DOUBLE DIAMOND GEARS are designed and built...

✓ ...to produce low installed cost

✓ ...to serve economically and dependably on the job for which you buy them

✓ ...and to do credit to your product and your reputation.

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AUTOMOTIVE GEAR WORKS, INC.

RICHMOND, INDIANA

FOR FARM EQUIPMENT, AUTOMOTIVE & GENERAL INDUSTRIAL APPLICATIONS

DOUBLE DIAMOND GEARS

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The Seal Won't Blow!

METALLIC-BACKED neoprene seals are used in this famous bearing — and they are engineered to *stay put*. They can't blow.

Your lubricant stays in; dust and dirt stay out; the result is years and years of trouble-free performance.

The "SC" Bearing is a service-proved member of the Dodge 30,000 hour line. Modern styling. Rugged one-piece cast-iron housing. Long inner race. Radial and thrust load capacity. Fully self aligning. *WRITE* for complete information on the "SC" Bearing in the Dodge catalog.

DODGE MANUFACTURING CORPORATION, 100 Union St., Mishawaka, Ind.

DODGE TYPE "SC" BALL BEARING PILLOW BLOCK

Precision built bearing for small shafts and moderate loads. Pillow blocks, flange bearings and hanger bearings available from distributors' stocks in shaft sizes ranging from 3/4" to 2-7/16".

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained, he can give you valuable assistance on new, cost saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone book.

DODGE

of Mishawaka, Ind.

FIRST IN POWER TRANSMISSION MACHINERY

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

Tangents by Tange

KICK IT

Some months ago, I sat with a number of other engineers in a general meeting. When the economist who was to address us stepped up to the microphone, he found it didn't work. All switches were on, and a twist of the amplifier knob produced the usual squeal in the loudspeakers. At that point, the economist said, "Surely, in such an erudite engineering audience, there are several electronic engineers capable of producing and operating much more complex equipment than this. Perhaps one of you might have a suggestion, in this, our hour of need."

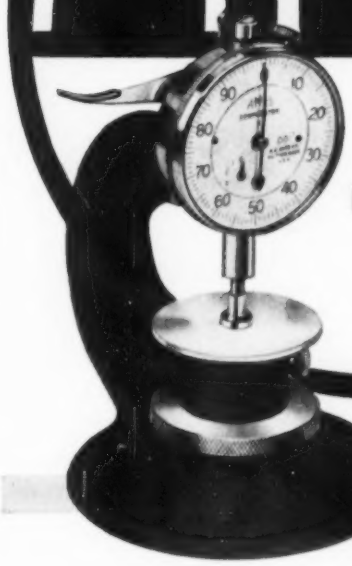
Clear and calm from the back of the room came the words, "Kick It!" Obediently, the economist kicked it—and was obviously disconcerted when the mike thereafter worked with no trouble.

Reminds me of the time, several years back, when I put together my own 23-tube radio, with the idea that it would give me $750 performance at a third of the cost. It worked like a charm, too, for about a year. Then it developed a buzz every time the tubes heated up. The tubes were all right as nearly as I could tell, and the noise seemed to be in the amplifier—it was there on AM, FM, and record player. I finally mentioned it to a friend of mine who has been a radio ham for years. "Hit each tube in turn with a screwdriver," he advised. "Sometimes a little bit of solder or something else is dislodged and gets where it doesn't belong."

I hit the tubes as directed—and the buzz was gone.

I mention these two cases to point up what every engineer knows, that the difference between a machine's working and not working is often infinitesimal. One little thing slightly wrong, and the whole shebang won't work. Remember the countless times you've made a clock, vacuum cleaner, radio, toaster, or other home gadget work—to your wife's admiration and your own amazement? How many

AMES



No. 2
Dial Comparator

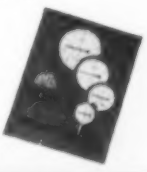
This is smallest in the Ames' line of high quality dial comparators and it is ideal for desk or bench use in the fine inspection of small precision parts. It is light in weight, but its broad base makes it very stable. The capacity approximates that of the regularly supplied Ames No. 202 Dial Indicator which has a dial numbered 0-100, graduated in .001" and with a .250" range. Should your job requirements differ, you can have the No. 2 with any Ames "Hundred Series" Dial Indicator. Send for Ames Catalog No. 58 covering the entire line of Ames Top Quality measuring instruments or, better still, send complete details of your Quality Control problem. Ames will suggest a solution – no obligation, of course.

Ames Long Range Dial Indicator No. 2822

Ames Dial Micrometer No. 516

Ames Dial Comparator No. 130

Ames Caliper Gauge No. 12B



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SALVAGE 95%

...of unproductive tool-change time

"Get Greater Precision, End Chewed-up Shanks"

"Eliminate Keys, Collets and Wrenches"

TO OPEN—Grip sleeve, pull down; jaws open automatically and tool is released.

TO CLOSE—Insert new tool, grip tapered part firmly; tool is locked in place.

Equip your drill presses, boring mills, jig borers, milling machines, lathes with

AMF WAHLSTROM *fully automatic instant change* CHUCKS

SAVE TIME—Changing tools in an AMF Wahlstrom Chuck takes only 2 or 3 *seconds—not minutes!* No waiting for the spindle to stop! No hunting for keys, collets or wrenches! Four hardened and ground jaws automatically center the tool and provide a grip that can't slip, can't chew up shanks. The greater the load, the tighter the grip!

SAVE MONEY—With AMF Wahlstrom Fully-Automatic Chucks on your machines, as much as 95% of the time usually wasted in changing tools can be converted into *productive* time—time that adds up to many hours per month . . . per operator.

SAVE CAPITAL INVESTMENT—A single spindle equipped with an AMF Wahlstrom Chuck does the work of *several* spindles . . . makes it practical to drill, ream and counterbore many different size holes successively, *without moving the work.* Model "A" (shown) available in two capacity ranges: 1/64" to 3/8" and 1/32" to 1/2". Other models for larger tools.

Ask your local industrial or machinery distributor for demonstration or write us direct for illustrated folder.

WAHLSTROM/FLOAT-LOCK SALES DEPT. (AM-3)

Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY, 511 Fifth Ave., New York 17, N. Y.

COMPARE Unretouched Photo

(UPPER) Tool used in Wahlstrom chuck. Note perfect shank. This tool has been repointed 17 times; inserted and removed 289 times.

(LOWER) Tool used in ordinary chuck. Note chewed-up shank. This can happen the *first* time chuck slips.

amf WAHLSTROM® CHUCKS AND TAPPING ATTACHMENTS FULLY-AUTOMATIC

See AMF's exciting, new television show, "OMNIBUS," every Sunday. Check local paper for time and channel.

times did you just disassemble, clean, and reassemble with your fingers crossed? I thought so!

RETROGRESSION?

A year or two ago, a superintendent told me he'd just bought ten new millers of a certain make. He and his men felt that two or three makes were equally good—but this particular design allowed the operator to sit down, while the others didn't.

Not too long ago, I was in a new cartridge-case plant that had ultra modern equipment generally, except for the lathes, which were relatively old in design. The engineer in charge explained that he could have bought the automatic electronically controlled units that would match his new-design presses and induction heat-treater, but that such lathes required skilled and specialized maintenance. He was sure that at least one would be in need of attention all the time, and in his area, hot-shot mechanics are few and far between.

The older design is a simple machine that anybody can maintain. He needed six for the job, so he bought eight—allowing one out for retooling and one out for maintenance at all times. That, in effect, has allowed him some built-in spare capacity.

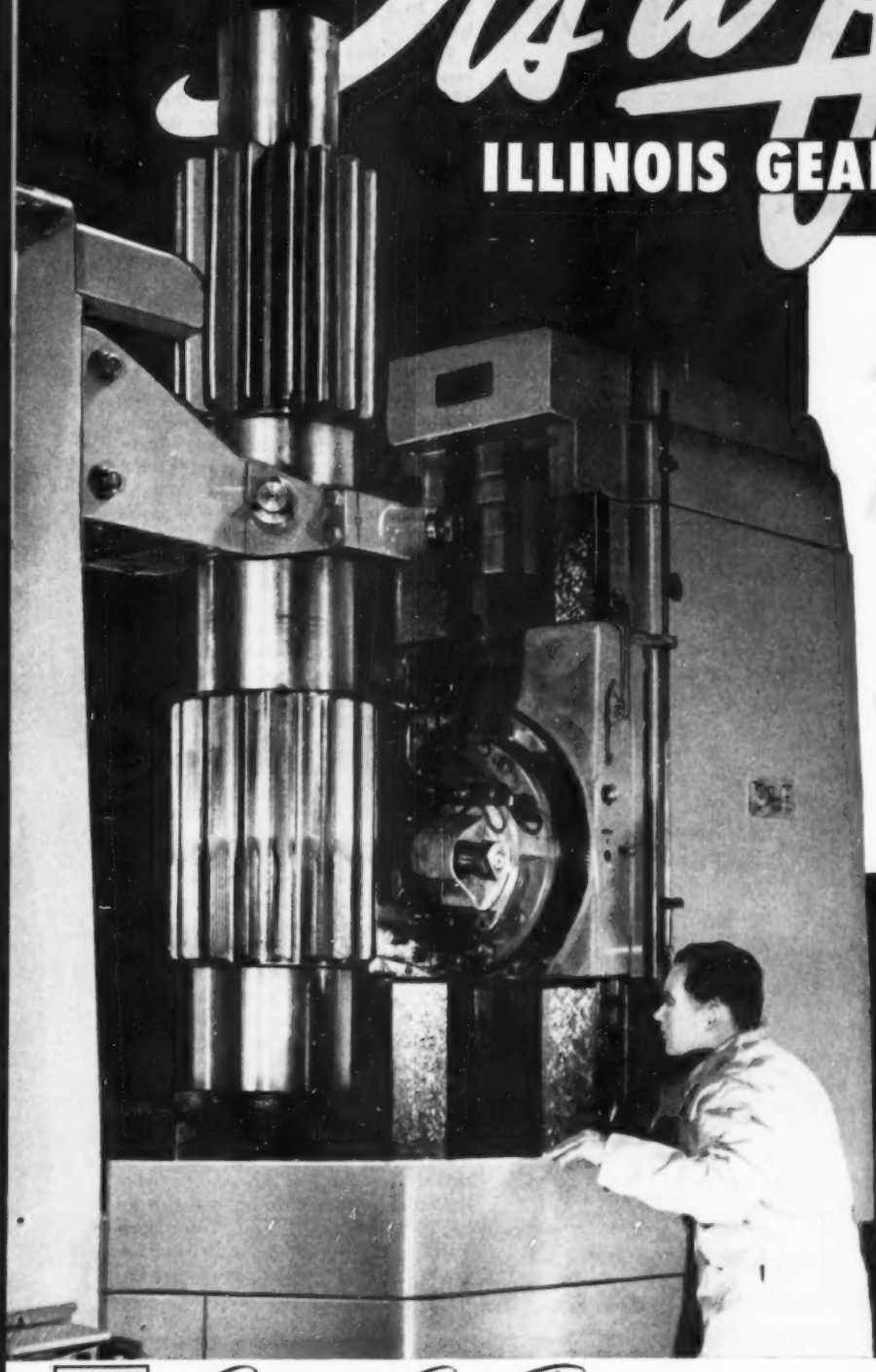
These two are by no means isolated examples. They, at first blush, indicate that, in the buyer's mind, some of the major sales points are actually minor ones. Some little difference becomes important in his decision because of his particular situation or condition.

Reactionaries could read into these occurrences the idea that change and improvement aren't worth the effort; that the buyer, given a choice, will take the familiar. Such beliefs could

"First let me give you the good news—this particular piece passed inspection!"

It's a fact-

ILLINOIS GEARS MEAN . . .



HIGHEST QUALITY

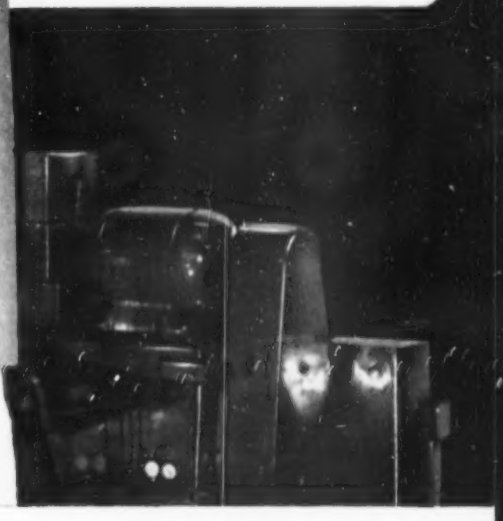
Quality cannot be "argued" into a gear. Illinois Gear *builds* it in.

PROMPT DELIVERY

Excuses don't keep your production line going or solve your breakdowns. Illinois Gear delivers fast — and always when promised.

REAL ECONOMY

Real economy comes from Illinois Gears in quality, accuracy, long life and on-time delivery.



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Gears for Every Purpose ... one gear or 10,000 or more

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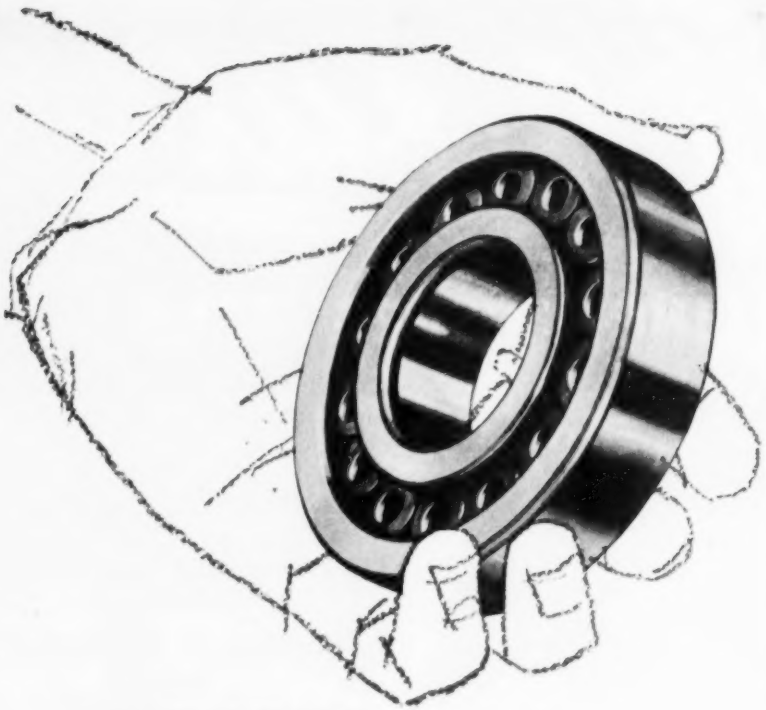

LEADERS

in American Industry

EQUIP *with*

BOWER ***bearings***

BEARING FEDERAL Mogul SERVICE

FEDERAL-MOGUL SERVICE

(Division of Federal-Mogul Corporation)

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Our 75 branches, in all principal cities, provide your bearing specialist with Federal-Mogul service on Bower bearings

soon lead to stagnation of ideas. The fact that some customers for grinders prefer the automatic feeds and motions to be cam-operated rather than electronic, or that some want no automatic elements at all, can readily lead to a misreading of the general trend.

In the two cases cited originally, one is a decision between two makes of millers, *both modern*, the other an isolated selection of older design among many selections of ultramodern design *in the same plant*.

Take, for example, the recent speech of David Wallace of Chrysler before the Society for the Advancement of Management. He said flatly that installation of completely automatic facilities in industry is often not worth while. The trick word in this statement is "often".

Mr. Wallace made no attempt to minimize the greater productivity resulting from completely automatic installations when they are made suitably. He said making operations all-automatic sometimes means substantial savings of space where space is at a premium.

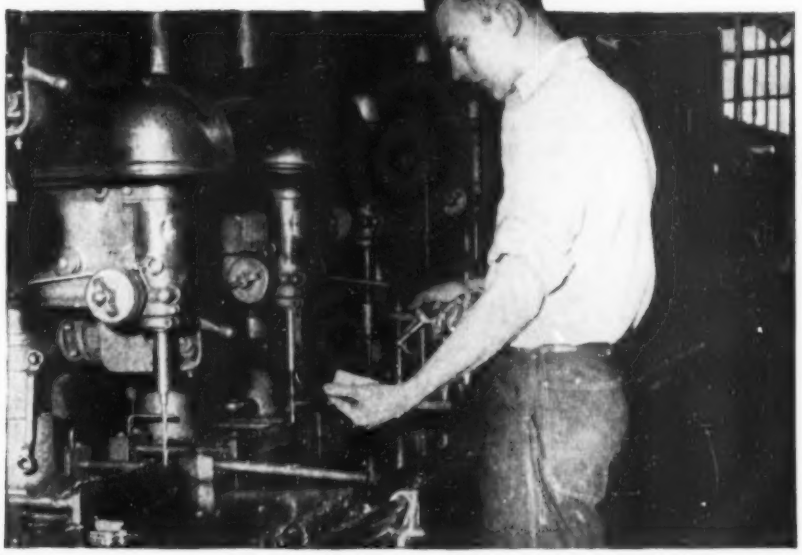
"However," Mr Wallace went on, "should ample space be available and if no other operation can be added to the vacated space, it is possible that the increased cost of automation may not provide such substantial savings as might appear in the first analysis."

Automation saves productive manpower on one hand and uses skilled workers in tight supply on the other, according to Mr Wallace. He urged employers to consider whether enough skilled electricians, machine repairmen and millwrights are available in their area before replacing any operations with machines.

What he termed "the satisfaction of personal ego" should not be allowed to influence a company's decision on installation of completely automatic facilities, Mr Wallace declared.

"Manufacturing is a cold-blooded, hard-fighting business," he said, "and there is no room in it for 'keeping up with the Joneses,' or doing things merely so that you can say that you have done them. I do not say this as an idle thought. I know of places where automation has been installed for no earthly reason other than the owner or manager just simply wanted it. In terms of the amount of capital we have been accustomed to using, automation is usually expensive. Unless the decision is made on facts rather than feelings, it could have serious financial consequences if applied too strongly in the wrong places."

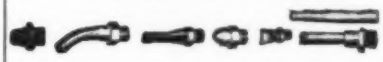
Put air at your fingertips with a Schrader Blow Gun



No. 9326 Drop Forged Stainless Steel | No. 7184 All Purpose Brass Button Type | No. 8785 Forged Brass Lever Type

ADJUSTABLE NOSES

NON-ADJUSTABLE NOSES



Choose the Blow Gun that suits you best from the thirty-six designs and styles of Schrader Blow Guns available. The interchangeable adjustable and non-adjustable noses also available make Schrader Blow Guns the most versatile you can buy.

You'll find there are Schrader Blow Guns that *just suit* any operation you may have . . . blow guns that put air *where* you want it . . . *when* you want it . . . reliably and economically. The #9326 Schrader Blow Gun shown in use above, for instance, will take years of the toughest treatment you can give it. Here's why . . .

- **It's rugged,** both in design and construction. This Schrader Blow Gun is *drop forged* of stainless steel to give you years of trouble-free service. Combine this with its countersunk nose and shielded operating button—and you'll see why it went right back on the job, even after we dropped it out of a tenth-floor window . . . then ran over it with a six-ton truck.
- **It's convenient**—Notice the handy hang-up hook. Hang the gun close to where you need it . . . and remember, too, this hook acts as a safety guard, to help keep hands away from moving machine parts.
- **It's economical**—This Schrader Blow Gun—or *any* Schrader Blow Gun—shuts off tightly the instant you lift your finger. A Schrader Blow Gun delivers air only while it's needed.

And this is only one of many designs and styles of Schrader Blow Guns available to you. At the left, you'll see typical examples of the several blow guns with interchangeable noses that will give you *exactly the blow gun you need.* Get full information by return mail!

Just write—or fill out the coupon below.

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Formbrite's superfine finish eliminated buffing on these parts

For the temple bow illustrated, Sunware Products Inc., New Britain, Connecticut, makers of Rayex Sun Glasses, formerly used ordinary drawing brass and finished this part by hand buffing—one at a time.

This was a costly procedure, so a switch was made to Formbrite* . . . then a happy thought occurred:

With Formbrite's superfine grain structure and added surface hardness, why not *tumble* these bows—by the thousands.

It was as simple as that. Formbrite's clean, smooth surface produced a jewelry finish—ready for gold-plating and lacquering. Since these bows are produced by the millions, the savings effected were substantial.

Formbrite, just in case you haven't heard, is a superior drawing brass. Comparative tests prove conclusively that the superfine grain structure of this specially processed forming brass means stamped and formed products that are stronger, harder, "springier" and more scratch-resistant. Yet the metal is so ductile that it can be readily formed, drawn and embossed.

Time studies made of finishing operations have shown that a bright, lustrous finish ordinarily can be obtained by a simple "color buffing" operation—or by tumbling, if the product lends itself to this method.

And yet, Formbrite costs no more. Convince yourself that Formbrite is the metal for your product. Write for Publication B-39. Address The American Brass Company, General Offices, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

5886

*Reg. U. S. Pat. Off.

Formbrite

an **ANACONDA**® Product made by The American Brass Company

NEW BOOKS

I REMEMBER—*An autobiography by Dexter S Kimball, Dean Emeritus of Engrg, Cornell University. Published by the McGraw-Hill Book Co, Inc, 330 West 42nd St, New York 36, NY. 259 pages, 5½ x8 in. Price $4.*

Thousands of men the country over remember Dean Kimball, have been inspired by his philosophy, and were saddened by his death last November. This book, as simple and straightforward as he was, is the chronological story of his life, plus that of the companies and institutions he touched. In it are no high-flown phrases nor pedagogic rantings; he just tells what happened to him from his birth at the end of the Civil War.

He was a lumberman born in Canada and a lumberman working in the Pacific Northwest, but a shopman at heart. So he tried working in a shop, but he wanted something more. So he went to the infant Leland Stanford University in 1893—two years after its founding—when he was 28, and got his degree at 31. For a time, he might have been designing engineer or works manager—in fact, he was both. But some overpowering urge made him a professor, to the great advantage of many Cornellians, and the world at large.

He could speak Chinook, cuss like a trooper, and handle tools with the best of them. He was not afraid to be a professor—it suited his philosophy, for a professor, as the Germans say, "thinks otherwise". And if he thought otherwise, he said so.

This, then, is his life, with some history and some philosophy thrown in. There is relatively little of his family life, except as it affected his professional life or his opinions. It shows the drive, the determination, the downright digging it took to come from nowhere and go where he wanted. It is the story of an era now closing, when a man who could have been a corporation president preferred to be a professor—and was surprised to be a dean.

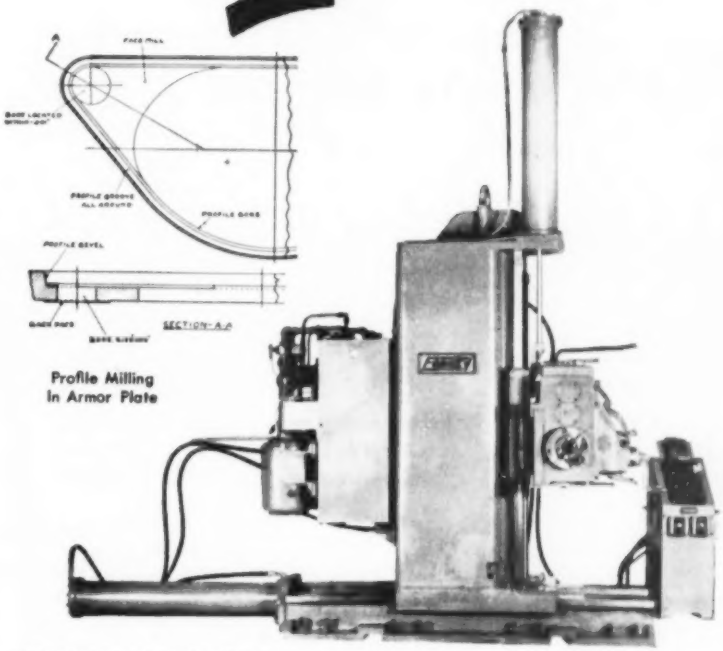
•

GETRIEBELEHRE I GEOMETRISCHE GRUNDLAGEN (THEORY OF MECHANICS I, KINEMATICS). (SECOND EDITION). *By P Grodzinski. Published by W de Gruyter & Co, Berlin W 35, Germany. 159 pages, 4x6 in. Price $2.40 DM.*

This booklet is No. 1061 of the famous Goschen series in which important facts and theories are published in condensed form. All books in this

FORNEY 1st

IN SOLVING INTRICATE PROFILE MILLING AND BORING PROBLEMS



Profile Milling In Armor Plate

—UNRETOUCHED PHOTOGRAPH

Forney specially engineered boring and facing machines make irregular, complicated profile milling and boring jobs routine. Difficult work on aluminum and magnesium castings and forgings is easy and economical with these complete "package", ready to run, horizontal profiling machines.

If you make spars, rib chords, fuselage bulkhead segments, wing ribs, wing hinges or other aircraft structural parts a new Forney boring and facing machine is a must. The same is true if you machine escape hatches, power mounts or drives for armored vehicles. You'll do any complex profile boring and facing job better for less with a Forney. Forney machines feature a spindle housing as a motor power unit which moves directly into the work face. This results in more accurate work, more power and rigidity in the cutting tool.

These custom made machines may be equipped with any type duplicator equipment with templates. Top quality work holding fixtures, tooling and floor plates are also available. Write or phone us today. Forney engineering consultants are ready to serve you immediately upon receipt of your drawings.

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Manufacturers of Special Machinery Since 1916

207 ELM STREET NEW CASTLE, PENNA.

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80% INCREASE IN PRODUCTION!
UNIQUE BALANCE CO. INC.

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NILSON 4-SLIDE

Wire and Ribbon Metal
FORMING MACHINES

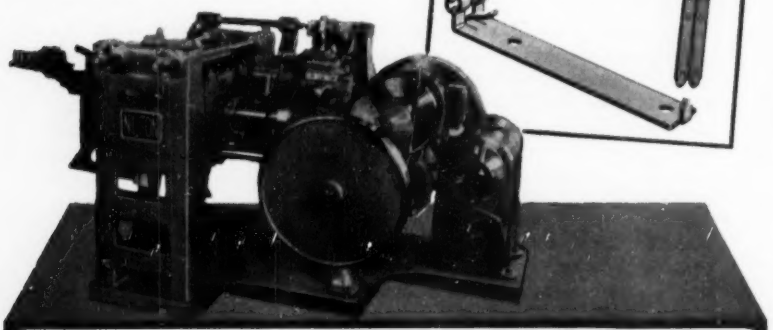
Plants from coast-to-coast are setting new production records with NILSON 4-SLIDE MACHINES . . . and experiencing tremendous economies and greatly improved quality.

Are you confronted with a keen competitive situation? Take the advice of hundreds of plant supervisors . . . install NILSON MACHINES and enjoy these economies *at once.*

NILSON combination press and 4-SLIDE forming machines take the stock directly from the coil — feed, straighten, pierce, blank, swage, stamp, coin — perform up to 5 forming operations and cut off . . . all in one quick, precise operation AUTOMATICALLY!

USING A NILSON COMBINATION PRESS AND 4-SLIDE FORMING MACHINE

Unique Balance Co., Inc. (one of the largest manufacturers of sash balance equipment), now produces 71,532 more parts out of the same amount of steel, compared to their former method. Production speeds increased from 100 to 180 pieces per minute.



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THE A. H. NILSON MACHINE CO.
1519 RAILROAD AVE. BRIDGEPORT, CONN.

Automatic Chain Making Machines • Automatic Staple Forming Machines • Wire and Stock Reels • Foot Presses • Wire Straightening Equipment • Slide Feeds for Presses

collection sell at the same price. This volume contains—in condensed form—the same subject matter that is contained in Usayen (American) and Canadian books on Kinematics.

Chapter I deals with the plane motion of particles. In Chapter II the relative motion of two planes is discussed. In this chapter, the theory of instantaneous centers, of centroids, and of points of no acceleration is developed. This theory includes the circles of inflexion points. The third chapter treats the plane relative motion of three planes. The four-link chain is given as an example, although it actually involves four planes. This chapter also contains two derivations of Coriolis acceleration. The fourth chapter is devoted to the kinematics of the slider crank and of its kinematic inversions. It investigates velocity and acceleration of the links. Chapter V is devoted to cams with sliding contact and with rolling contact.

A long chapter without number is called Geometric Relations. In it the following subjects are discussed: Movability with and without constraint, design of linkages, motion of points in the plane belonging to the connecting rod, design of cam mechanisms, fundamentals of toothed (spur) gearing and valve-lifting cams.

Everything is well explained, although the explanations are necessarily brief. The print and illustrations are excellent. The reviewer did not find the kinematics of spherical motion, such as bevel gears and universal joints.

The reviewer owns a number of Goschen booklets and has often wished that similar publications were available in the English language.

Reviewed by W Trinks

•

GENERAL CATALOG OF THE GERMAN TOOL INDUSTRY, *Vol. 1—Published by Verlag W. Girardet, Essen, Germany, for the Cooperative Organization of German Tool Makers, Colmanstrasse 45, Bonn, Germany. 316 pages, 8¼ x 11½. Price DM 42.00 linen bound, DM 48.80 half leather bound.*

This is a most unusual book in that it is not the catalog of any manufacturer, nor are any manufacturers' names given in it. Nevertheless, it presents in catalog form all the different types of tools produced in Germany, gives their names in German, English, French, Spanish, and Portuguese, and lists the general di-

Which soils are hardest to remove?

WHAT METALS DO YOU CLEAN?

- ☐ buffing compound residues
- ☐ pigmented drawing compounds
- ☐ oils and greases
- ☐ heat scale
- ☐ tarnish
- ☐ rust, oxides
- ☐ carbon smuts
- ☐ flux residues
- ☐ rust preventives

from

- ☐ steel
- ☐ brass
- ☐ copper
- ☐ aluminum
- ☐ magnesium
- ☐ lead
- ☐ zinc

Can you electroclean brass without tarnishing? Do you find buffing compounds or carbon smuts hard to remove? Would you like to remove rust and oil in one cleaning operation? —You'll find real efficiency and economy in Oakite methods for metal cleaning. Tell us your problem and let us send you the FREE booklet.

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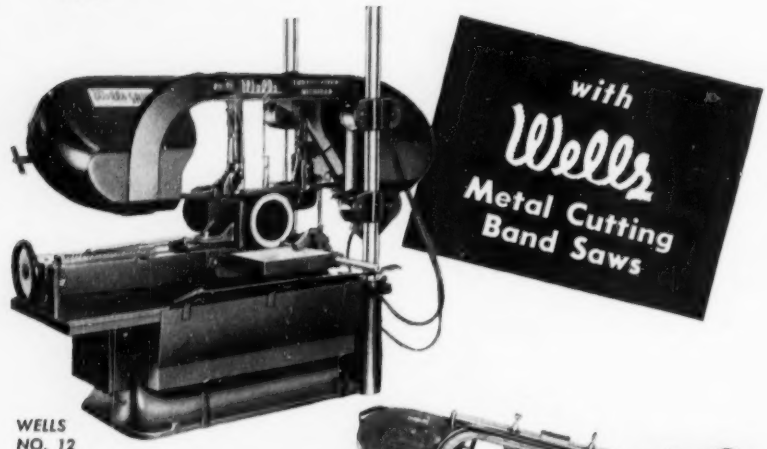
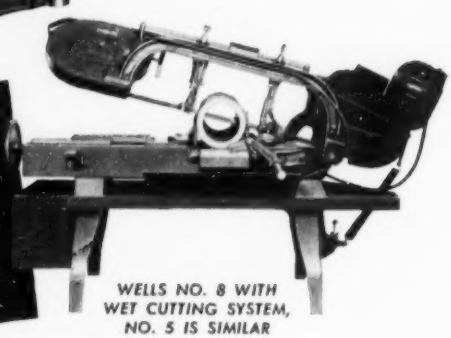


WELLS NO. 12

featuring an Expanded Range of Cutting Speeds



WELLS NO. 8 WITH WET CUTTING SYSTEM, NO. 5 IS SIMILAR

TO IMPROVE cutting efficiency and production, three models of the Wells Metal Cutting Band Saw line are now available with expanded range of cutting speeds as standard equipment. The table below shows the new speed ranges for these outstanding machines . . . Wells Nos. 5, 8 and 12 . . . first in the horizontal field. Higher speeds are available when required.

The new cutting speeds coupled with such proved Wells advantages as sturdy construction, ease of operation, real dependability and low cost make these machines even more profitable for you to use. Ask your Wells Dealer for full information or write, requesting catalog G-52 giving specifications and design details for all models.

Model	Capacity		Selective Cutting Speeds
	Rounds	Rectangular	
No. 5	5" O.D.	5" x 10"	50, 90, 160, 250 f.p.m.
No. 8	8" O.D.	8" x 16"	50, 100, 175, 275 f.p.m.
No. 12	12¾" O.D.	12" x 16"	60, 115, 200, 300 f.p.m.

SEE US AT THE WESTERN METAL SHOW

Wells saws

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
505 ROOSEVELT RD., THREE RIVERS, MICHIGAN

mensions and weights in English and metric units.

Every item is illustrated with a photograph to give a clear idea of the general form of the tool, and only standard models are shown. It is mentioned, however, that special tools can be supplied to order. Many of the tools shown seem strange to American eyes, and it is most interesting to note the differences between common tools, such as machinists' hammers, in German, English, American, and other patterns. The illustrations are designed to show only the essential characteristics of the various tools, as details may differ slightly with different suppliers.

Every item is given a code number to facilitate ordering, and detailed information is given on ordering procedure. Prices are not given, as these will necessarily vary with different manufacturers.

Inquiries for standard tools should be sent to individual companies listed in the separate index. When special tools are required, the inquiry may be sent to Fachverband Werkzeugindustrie, Remscheid, Germany. Such inquiries will then be passed on to member firms able to deal with them, or suitable names and addresses will be forwarded to the customer.

This first volume covers hand tools for wood and metalworking; the second and third volumes covering precision and measuring tools will be published in the near future.

•

INDEX TO MANUFACTURERS OF TOOLS, PRECISION TOOLS, AND MEASURING TOOLS—*Published by Verlag W. Girardet, Essen, Germany, for the Cooperative Organization of German Tool Makers, Colmanstrasse 45, Bonn, Germany. 180 pages, 7¾ x 8¼ in. Paper bound. Price DM 6.40.*

This is an index to the General Catalog of the German Tool Industry and gives the names and addresses of all members of the association. Like the general catalog, it is in five languages. It is divided into four sections. The first part is a key for locating manufacturers by company name or product; part two gives company names and addresses and a cross-reference to product; part three lists products and the names of their manufacturers; part four is an alphabetical list of products with page and section number.

The index covers all three volumes of the general catalog and is indispensable if full use is to be made of them.

NEW FRACTIONAL H.P. MANUAL STARTER HAS *ALL* THE FEATURES!

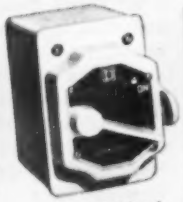
right:
Class 2510
Basic Starter Mechanism

DESIGN LEADERSHIP IN THESE FEATURES:

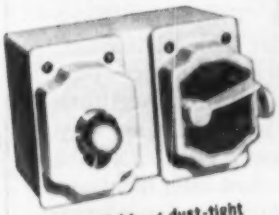
- ✓ Quick-make, quick-break contact mechanism
- ✓ Single or double pole construction
- ✓ Double break contacts of fine silver
- ✓ Modern styling
- ✓ Straight-through wiring with convenient terminals—generous wire space
- ✓ Dependable melting alloy type overload protection—trip-free
- ✓ Definite trip indication
- ✓ Interchangeable overload relay units accessible from the front
- ✓ Open type starter can be used with standard switch box and flushplate

a Variety of Enclosures

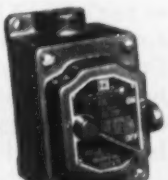
General purpose enclosure—with or without pilot light



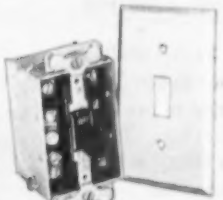
Water-tight and **dust-tight** enclosure



Water-tight and **dust-tight** with pilot light



Explosion-resisting enclosure. For hazardous locations—Class I Group D and Class II Groups E, F and G.



Flush mounting. Basic starter mechanism can be used with standard switchbox and flush plate — or with flush plate only for machine tool cavity mounting.

RATINGS

Double pole
1 H.P., 115-230 volts A.C. or D.C.

Single pole
1 H.P., 115-230 volts A.C. and ½ H.P., 115-230 volts D.C.

Write for Bulletin 2510A. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 • **50** YEARS OF DESIGN LEADERSHIP • 1953

SHELDON

CHICAGO U.S.A.

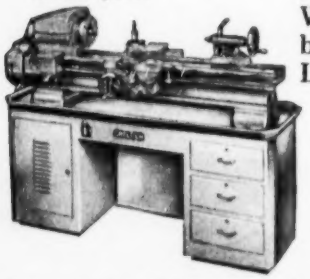
PRECISION LATHES

Precision that lasts

..."ZERO PRECISION" TIMKEN TAPER ROLLER BEARINGS

SHELDON
"Stamina" Features:

- Rigid, Heavily cross-strutted 1-piece Beds—2 V-ways, 2 Flat ways
- Full Double-Walled Aprons—all gear shafts supported on both ends.
- Heavy Carriage with wide bearing on bed.
- Twin V-Belts to Spindle for extra power.



No lathe can be more accurate than its spindle bearings. Hence before buying any lathe one should check the *exact* type and tolerances of bearings used.

The No. TS-56B (and several other) SHELDON Precision Lathes have Timken "Zero Precision" Taper Roller Bearings, held to tolerances of .00015". Not only are these the most accurate bearings used in any lathe, they are the sturdiest type . . . hold their accuracy thru long hard use . . . hold it even under abuse. With the other stamina features built into SHELDON Precision Lathes, they assure continued accuracy, without costly maintenance, thru years of hard service.

Write for Catalog

SHELDON MACHINE CO., INC.
North Knox Ave., Chicago 41, Illinois

NAMES in the NEWS

•

John F Neff has been appointed Toledo sales manager for Aro Equipment Corp's line of industrial lubricators and air tools.

S R Rushworth has been named purchasing agent for Oliver Corp's Cleveland plant.

Walter A Meyer has been named general sales manager for Furnas Electric Co, Batavia, Ill, and will be in charge of sales and publicity for its line of electric motor controls.

Alexander B Freeman, who began in 1912 as a stock clerk in American Brass Co's Metal Hose Branch, has been named vice president.

Hobart E Switzer, formerly director of inventory and production schedules for Diebold, Inc, has been appointed purchasing agent for electric Regulator Corp, Norwalk, Conn.

William S Hemsley has been appointed Chicago district manager for Simonds Abrasive Co.

James L Wick, president and treasurer of Falcon Bronze Co, Youngstown, Ohio, has been named board chairman. Succeeding Mr Wick as president is **L M Nesselbush,** vice president and general manager. Company Secretary **David A Endres** will take on Mr Nesselbush's duties as vice president, while Mr Wick's post as treasurer will go to **John A. Noll.**

Dr Cledo Brunetti will resign as associate director of Stanford Research Institute, Palo Alto, Calif, to accept an executive research post with General Mills Co's Mechanical Div, Minneapolis, March 1. He will set up a general research and industrial development laboratory for General Mills.

Dean W Paul has been appointed sales manager of General Dynamics Corp's Electro Dynamic Div, Bayonne, N J. A veteran of 14 years in the industrial electric motor field, he will assist in directing a sales expansion program.

John F Canaday is the new corporate director of public relations, and **Don H Cameron** corporate director of industrial relations for Lockheed Aircraft Corp. **William R Wilson** suc-

ceeds Mr Canaday as public relations manager, California division. **Donald M Wilder** succeeds Mr Cameron as industrial relations director, California division. Also promoted: **H W Bissell** to personnel manager; **Merrill J Cate** to labor relations manager.

Herbert J Niemann, new vice president in charge of sales, is one of four top executives recently appointed by Hydro-Blast Corp, Chicago. Others are: **P C Will,** vice president in charge of engineering; **W F Gamble,** secretary-treasurer; **John W Watson,** chief production engineer.

Wilbur C Stauble has been elected president and chief executive officer of Holo-Krome Screw Corp, Hartford, Conn, and a director and member of the executive committee of H-K's parent company, Veeder-Root, Inc. He succeeds US Senator **William A Purtell.**

L E Ritter, has taken charge of F J Stokes Machine Co's new St Louis office. His sales territory includes Kansas, Missouri, Arkansas, Louisiana, New Mexico, Oklahoma, Texas, Illinois.

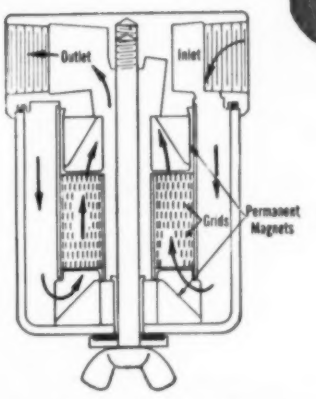
Kent M Campbell has been appointed assistant manager of Solar Aircraft Co's San Diego contracts division; and **William F Cords** chief of aircraft and engine contracts.

William Hagel, vice president in charge of sales, and **Maurice P Sieger,** vice president and senior engineer for United Engineering & Foundry Co, Pittsburgh, were recently elected to fill board of director vacancies.

Carl Welke succeeds **Ralph J Miller, Jr,** who has been transferred to the Chicago office of Gisholt Machine Co, as a Cleveland sales representative for the company. Also announced by Gisholt is the retirement on January 1 of **George E Thomas,** for 36 years its sales representative in New England.

Leonard P Meligren has been appointed head of De Laval Steam Turbine Co's new district office at Northwestern Bank Bldg, Minneapolis.

George M Bunker, president of Glenn L Martin Co, heads a list of four new directors elected by National Can Co. Others are: **C S Harding Mott,** vice president and trustee, Charles Stewart Mott Foundation; **Douglas Casey,** president, A C Allyn & Co; and **A E Repenning,** vice president of the Interamerican Orange Crush Company.



FRANTZ MAGNETIC SEPARATORS

help stop damage to lubricated machine parts by removing iron and steel particles and chips from lubricating oil lines

If parts replacement and maintenance are eating into your profits, you can lay part of the blame on metal worn off gears, pumps, and other working parts of your machines. Unless removed, these abrasive particles build up and the circulating oil feeds them between lubricated surfaces. The answer to this problem is the FRANTZ FERROFILTER which traps iron and steel particles in a stack of grids placed between powerful permanent magnets. This is sure-fire protection for all parts subject to wear. FERROFILTERS are also used on coolant lines to lengthen tool life and help provide better finishes; cut down rejects.

TRIAL OFFER—Rent one or more FERROFILTERS at low cost to prove their efficiency on your job. Write for details.

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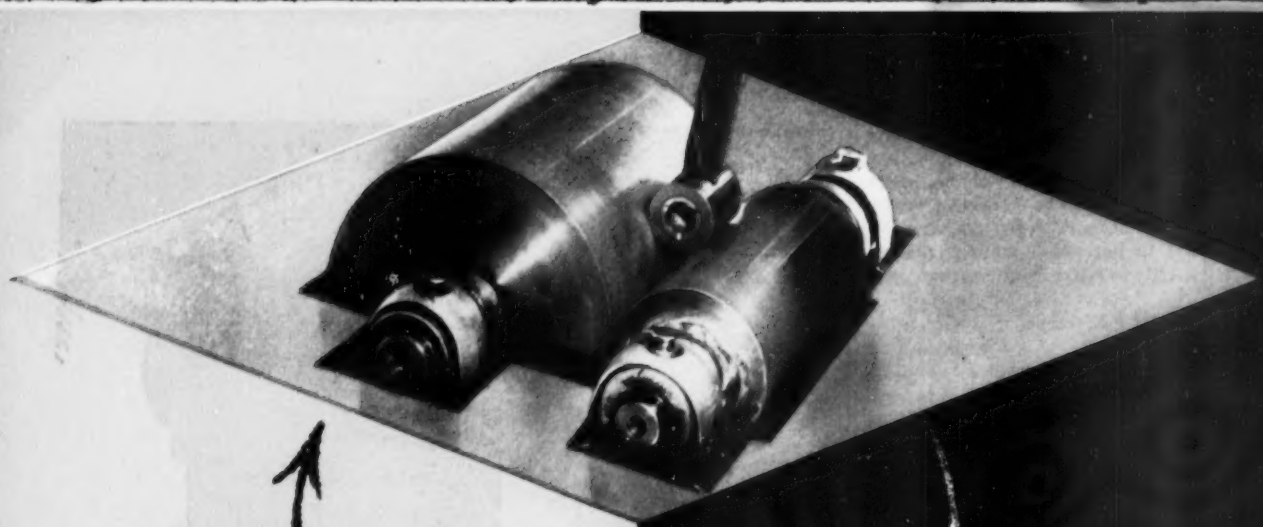
S.G.FrantzCo., Inc.

P. O. Box 1138 Trenton 6, N. J.

Manufacturers of Permanent Magnet and Electromagnetic Separators



Precision finishing with a Precision Abrasive

At the Size Control Company . . . Chicago, Illinois

Precision gage production
presents a difficult finishing problem.
A fine, long wearing finish must be achieved just
as the piece is brought to exact size—there is no excess
material left for refinishing if a scratch develops. Only the finest, most
reliable abrasives can be used. That's why, at Size Control Company, they . . .

Finish with Diamond . . . ELGIN Diamond!

ONLY ELGIN DIAMOND IN DYMO

is precision graded right in the Elgin laboratories

ORDINARY DIAMOND

ELGIN DIAMOND

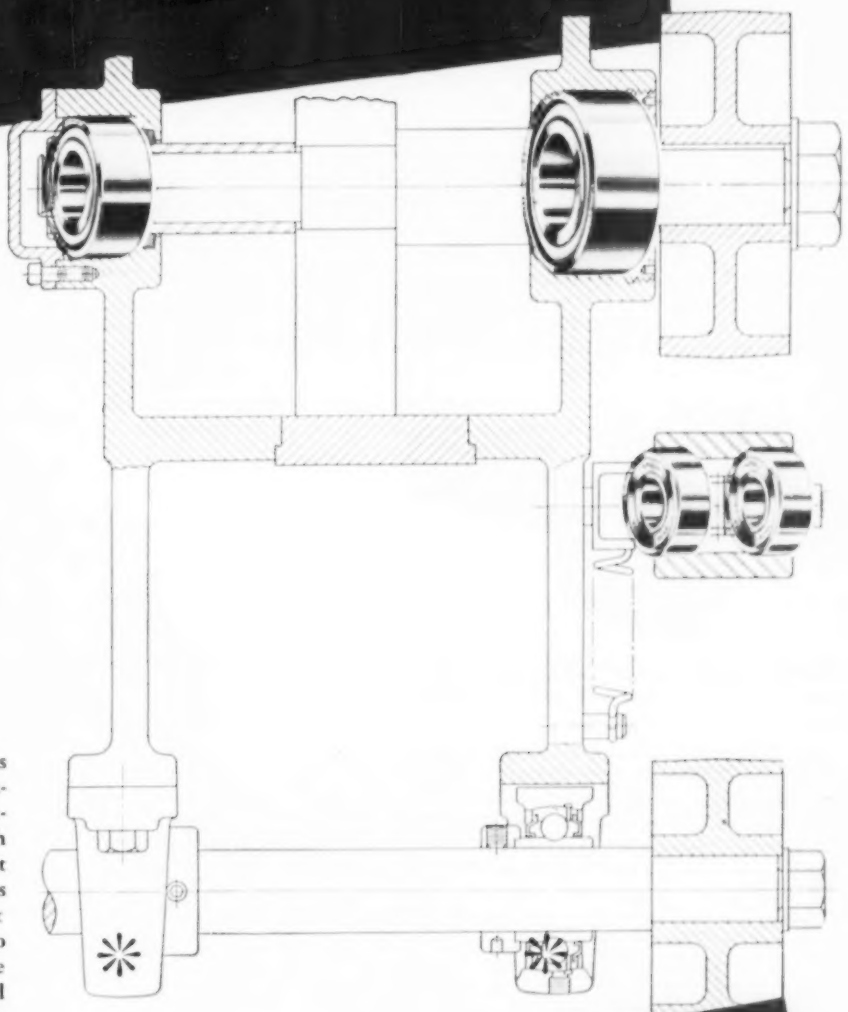
ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS

Dept. B

GOING STEADY...for 16 years

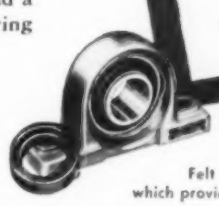


Arbor Spindle Assembly on Polishing Machine

In 1937, this arbor spindle was constructed and put into operation. It has been running constantly since then . . . through World War II and the present Defense Era. By means of various pulley and belt combinations, it has a speed range from 585 to 10,000 r.p.m. on the arbor spindle pulley. The assembly is equipped with grease-lubricated ball bearings . . . none have been replaced.

Maintenance problems were practically eliminated by the careful selection and arrangement of the right bearings on this installation . . . and the assembly's service life was extended materially. Here is a typical example of the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the user's viewpoint, an aptitude for coming up with the precise bearing to fit the need. Maybe this combination can help you find a better, cheaper way to use bearings. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA



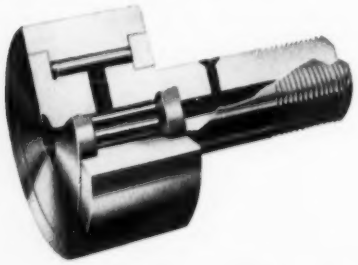
***Fafnir Standard Duty Pillow Blocks** incorporating Fafnir Wide Inner Ring Bearings with Mechani-Seals are used in addition to Fafnir Felt Seal type Ball Bearings and Fafnir Double Row Bearings which provide increased axial and radial rigidity in limited space.

CAM ACTION IMPROVED with MULTIROL® BEARINGS

under heavier loads • with shock resistance • and space economy

Modern demands for faster, more automatic machines necessitate a new approach to cam action efficiency. Improvised bolt and roller units are no longer adequate for this mass production machine age.

Machinery manufacturers are finding that even at slow speed, it is difficult to carry the usual heavy radial and intermittent shock loads of cam application efficiently on plain bearings or standard antifriction ball and roller bearings. With increasing speeds, and lubrication limited by the desire for simplified design, the plain bearing wears excessively and fails early. Ordinary ball or radial roller bearings used on a shaft as cam followers have a



tendency to split in the outer race because of the excessive strain on the thin and superhard race sections.

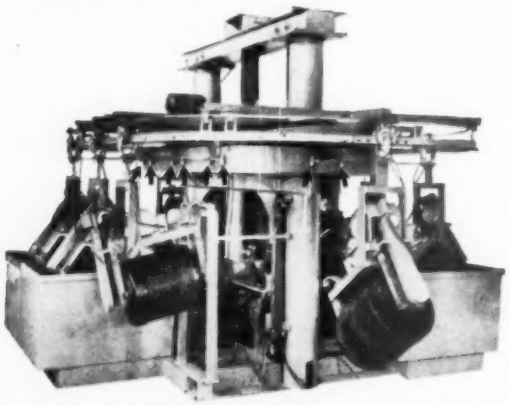
One bearing that has proven particularly successful in cam follower applications is the Multirol CF series full type roller bearing. This bearing is built especially for the repeated shock loads of typical cam action operations. The outer race section is not only heavy radially but is also martempered to combine maximum toughness with adequate surface hardness for withstanding the punishment of cam applications. The outer ring operates on a full complement of small diameter rollers so the load is evenly distributed over a greater bearing surface. The inner race and flange are made in a single piece with the stud, preventing any possibility of disassembly in operation. Greater accuracy is maintained throughout longer bearing life and, compared with plain bearings, both starting and rolling friction are reduced to a minimum. As a result internal wear is diminished and power requirements of Multirol bearing equipped machines are appreciably lessened.

Load Capacity Comparison

To illustrate the increased capacity of the Multirol CF, here is a comparison between a Multirol CF-1 bearing and a corresponding friction type roller, making use of the maximum permissable bearing pressures in pounds per square inch of projected area. The CF-1 bearing will have a maximum of 2240# while the equivalent friction type roller would have a capacity of less than 400#.

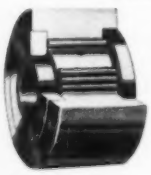
What This Means in Terms of Performance

The James Hunter Machine Co., of North Adams, Massachusetts replaced units consisting of a standard roller bearing and hardened roller with Multirol CF bearings on eccentric cams that actuate rake teeth in their wool washers. The changeover reduced their original and replacement costs over 10% and reduced maintenance to occasional lubrication. Where previously, rollers only lasted a maximum of several months, no replacements have been required with the Multirol bearings. As a result, the Multirol Bearings solved a trouble spot that brought in many customer complaints.

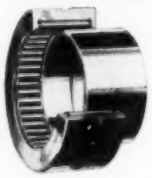


Crown Rheostat and Supply Company of Chicago uses up to 200 Multirol Cam Followers as guide and support rollers in the travel and transfer mechanism of their cleaning, plating, and drying machines. Formerly trolleys were suspended from rails but the cam follower units proved to be a more precision means of friction reduction and added stability to the supporting arms.

Other McGILL® Bearings



MULTIROL CYR



MULTIROL SE

GUIDEROL CT

A new 140-page Bearing Reference Guide complete with 30 pages of vital engineering data has just been released by the McGill Manufacturing Company. It has the full story on the advantages of Multirol CF Bearings as well as information on the Multirol CYR, Multirol SE and Guiderol Bearings. Send now for your copy of McGill Catalog No. 52.

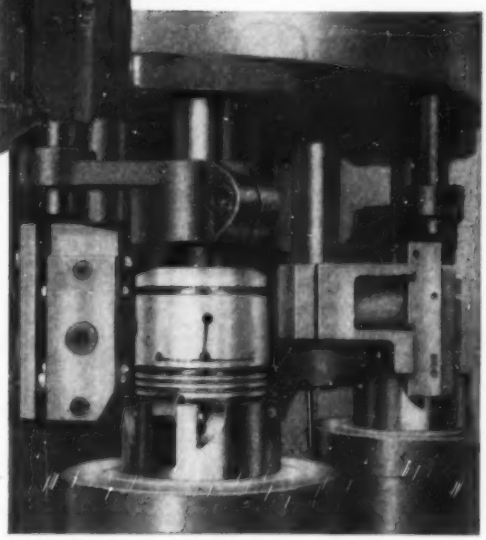
McGILL® — Precision Bearings

McGILL MANUFACTURING COMPANY, INC.
300 N. Lafayette Street, Valparaiso, Indiana

ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

(Above) Front view, showing splash guards for wet cutting.



(Right) Close-up view of a typical Baird tooling set-up.

TOOLS MOVE HORIZONTALLY, OTHERS VERTICALLY, FOR FACING . . . TURNING

. . . and that's but one of the excellent features of Baird's No. 54VC (5" chuck, 4-spindle, vertical continuous lathe). As the turret revolves, eliminating unproductive indexing time, holding fixtures grip and release automatically for easy loading and unloading. Tools feed in and out of the cutting stroke.

Typical applications are boring piston ends, facing, chamfering, turning bands, etc., for wet or dry cutting of light jobs. In most cases, the spindle carrier cycle time is 12 - 38 seconds; production time 3 - 9 seconds per piece; cutting time 9 - 28.5 seconds.

Safety for operator and prevention against machine and product damage are mechanically and electrically controlled; tools cannot feed to work unless spindles are revolving; electrical equipment is enclosed, wiring concealed.

FEATURES
BAIRD 4-SPINDLE VERTICAL LATHE

1. Compact design.
2. Easy to tool and operate.
3. Simple . . . dependable.
4. Extremely accurate.
5. Unusually versatile.
6. Outstanding production records.

Installation of Baird automatic machines is a step in the right direction against tough competition. "Ask Baird about it!"

5BA53

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STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

The above **Talide Tipped Centerless Blades** illustrate the wide range and variety of work supports we make. In addition to standards, you may need blades for grinding multiple diameters, steps, tapers, contours or special shapes. You can obtain any shape or size of blade required for your centerless grinders from our extensive stocks or engineering files.

As a production man or designer, you are familiar with the advantages of **Talide Carbide.** This super-hard metal outwears any conventional material as much as 50 times. Notice, too, the long one-piece strip (up to 100") which eliminates chance of scratching or marring expensive ground and polished parts.

You can obtain **Talide Centerless Blades** on same day or 24-hour service from our warehouses in Newark, Youngstown, Detroit or Chicago.

Write Metal Carbides Corporation, Youngstown 7, Ohio.

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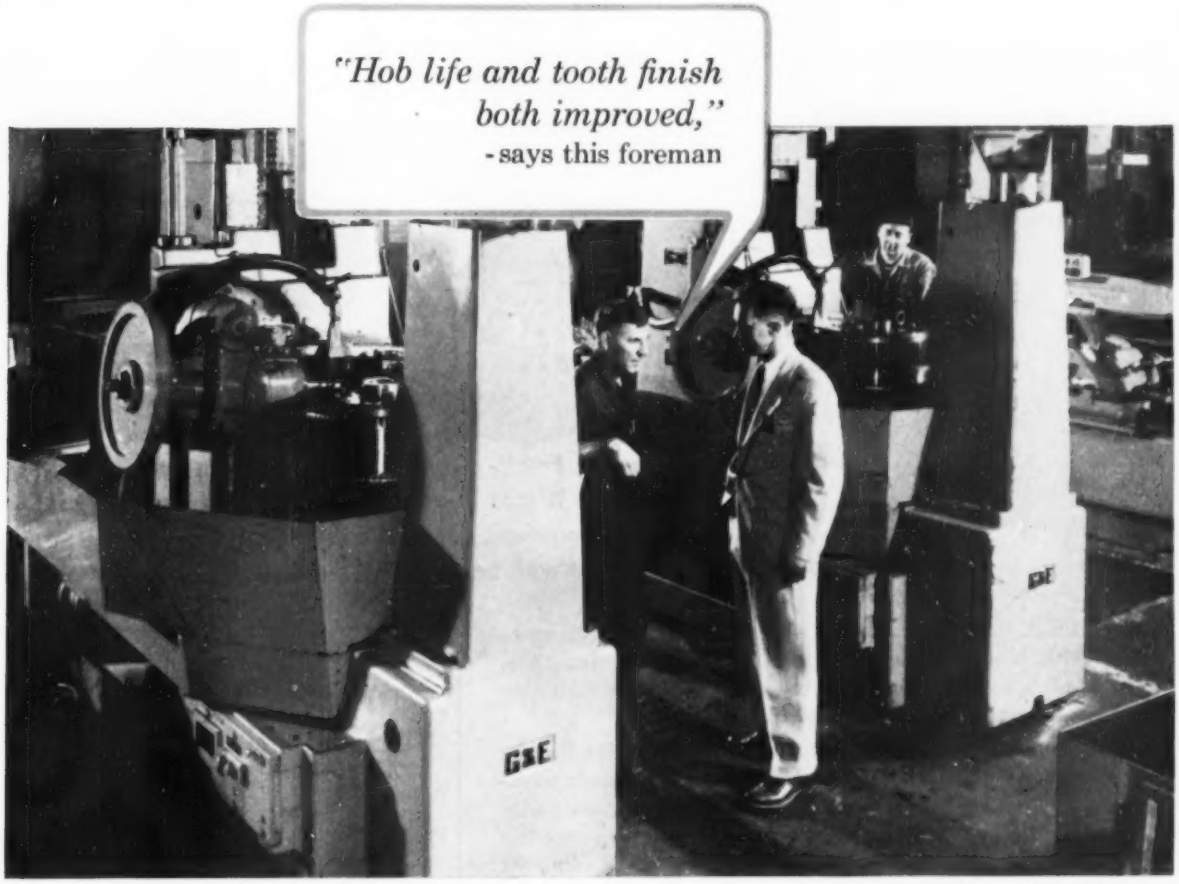
For special blades, send us prints direct to Youngstown. Prompt quotations.

New Blade Catalog 52-G *available upon request.*

alloy steel drive gears for M-47 tank

hob better with GULF ELECTRO CUTTING OIL!



Operation—cutting involute teeth on alloy steel spur gears, Gould and Eberhardt Gear Hobbers; results with Gulf Electro Cutting Oil—Hob life increased 20%, scuff marks eliminated on gear teeth, and hob grinding costs reduced.

Here's the important reason why Gulf Electro Cutting Oil produces outstanding results like these: Thanks to a special Gulf process of combining sulphur, it provides greater sulphur activity over the entire range of a cutting operation. This means longer tool life and better finishes.

Call in a Gulf Sales Engineer today and arrange to use this quality cutting oil on your tough machining operations, or send the coupon below for additional information.

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Gulf Oil Corporation · Gulf Refining Company AM
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Please send me, without obligation, a copy of your pamphlet "Gulf Electro Cutting Oil."

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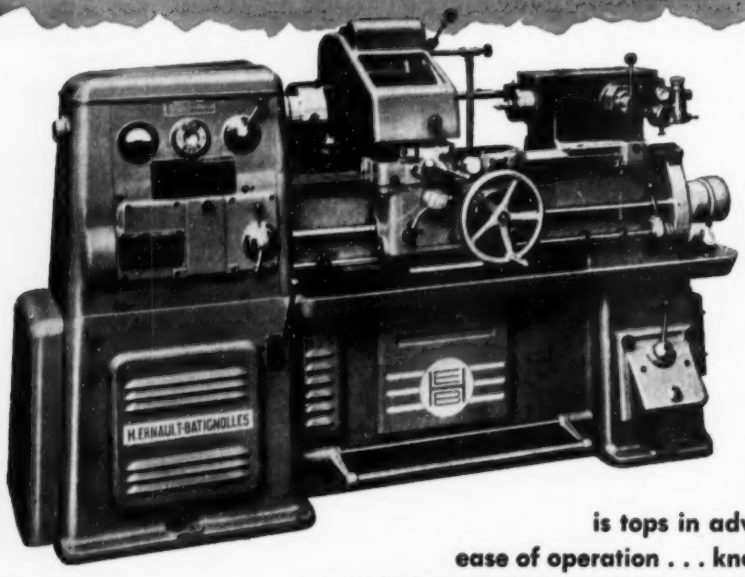
Production tested and approved in over 1,000 plants



HIGH SPEED HYDRAULIC COPYING LATHE

Those who have *compared* copying lathes know the H.E.B. is tops in advanced design, construction and ease of operation . . . know that the H.E.B. means faster, trouble-free production with better finish, no distortion of the work.

The H.E.B. Copying Lathe has higher spindle speeds—up to 3600 RPM in the **OP Models** to take full advantage of carbide. **GT Models** with rotating pattern are designed for copying an infinite variety of irregular, non-circular work.

You won't find *chips* any problem at all. A sloping bed together with a built-in coolant pump result in automatic wash-away of the chips into a rear pan, from which they are easily removed *without stopping the machine.* Featured too are the power operated back tool posts which are part of the standard machine.

Remember, the H.E.B.'s patented copying device is an integral part of this ruggedly constructed lathe, resulting in rigidity and accuracy. Setting time is reduced to a handful of minutes, and finished parts are copy-turned up to 300% faster than on multi-tool lathes.

Designed and built in France by H. Ernault Batignolles—machine tool manufacturers for almost a hundred years!

If you are planning to make an investment in a copying lathe you want the best . . . Study our insert in Sweet's Machine Tool Catalog—Or write or phone us for detailed catalog or a demonstration!

TYPE 178 CONSTAN CARBIDE TOOL GRINDER

•

Specially designed for carbide tools without attachments. Heavily built, the Constan combines smooth operation and ease of setting with great rigidity. The inclinable table incorporates a ball and socket vise so that the tool may be clamped in any position. Two diamond wheels are mounted on the wheel head, and each may easily be brought into position.

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"THE WAY TO TURN"

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tool steel is the cornerstone of our business

Just as the cornerstone is of fundamental importance to a building, tool steel is the base of our business. And ever since we were founded — now over 50 years ago — we have been proud of our reputation as the nation's leading producer of tool steels.

We have always given our customers what they needed — quality and service — regardless of their volume of business or the general supply and demand situation. During last year's steel shortage, for instance, all our customers had their share of our production.

You too, can benefit from our long experience in this field through our freely available metallurgical service . . . and from our reliable delivery service through our fully stocked warehouses, conveniently located all over the country.

SEND TODAY for the unique Crucible Tool Steel Selector — a twist of the dial gives the tool steel for your application.

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CRUCIBLE first name in special purpose steels

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YOUR MEN *asked for these* AIR GRINDER FEATURES!

For increased production, dependability and safety, check your present portable grinding equipment against these Ingersoll-Rand features:

Overspeed Safety Coupling—If the regular governor, because of wear, abuse, improper adjustment, or dirty air, allows the motor to overspeed, the overspeed safety coupling automatically disconnects the arbor and the wheel from the motor.

Quieter Exhaust—It takes 10 of these Grinders to produce exhaust noise equal to that of one previous machine! This means increased operator morale and top grinding efficiency!

Extra Exhaust Positions—The operator can choose any one of four exhaust positions, so that the exhaust air does not strike the operator's body or hit the work and blow grit and metal particles about.

Easy to Carry—There is plenty of room behind the throttle lever for a comfortable grip. The Grinder may be easily and safely carried while it is connected to the air line.

More Power—A larger motor maintains higher speed under normal grinding loads to remove more metal in less time.

Optional Handle—The popular grip handle is interchangeable with a straight handle where the operator's preference or the job at hand calls for it.

Long Life Arbor Construction—Widely spaced, permanently lubricated ball bearings maintain rigidity and accurate alignment, assuring long life and trouble-free service.

Rubber-Faced Valve—For air economy the rubber-faced throttle valve seats better under all conditions, even with a dirty or pitted valve seat.

Call, write or wire your nearest Ingersoll-Rand office—one of our Grinder engineers will demonstrate what Operator Engineered Grinders can do on your jobs!

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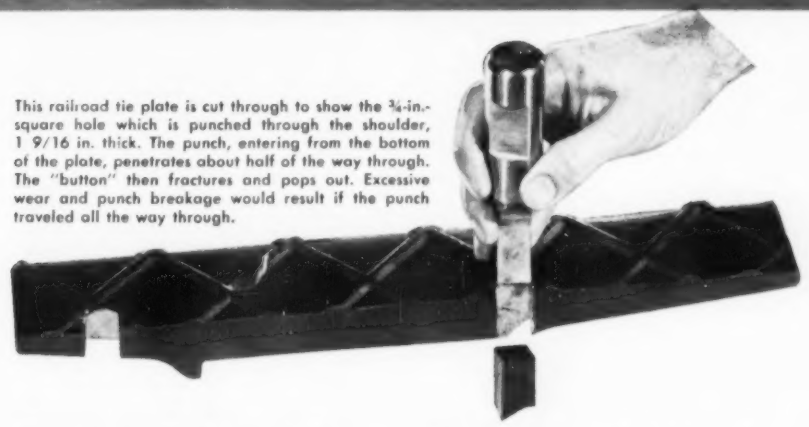
COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



This railroad tie plate is cut through to show the ¾-in.-square hole which is punched through the shoulder, 1 9/16 in. thick. The punch, entering from the bottom of the plate, penetrates about half of the way through. The "button" then fractures and pops out. Excessive wear and punch breakage would result if the punch traveled all the way through.

Omega Adds 5 Lives To Rugged Punches

When a punch can average only 54 holes before failure, you would figure that the job is a tough one. And you would be right. Punching ¾-in.-square holes through 1 9/16-in. of tough steel in railroad tie plates is no job for an ordinary tool steel.

One of our metallurgical contact men studied this severe punching operation and recommended the use of our Omega tool steel. He pointed out to the shop men that it takes a shock-resisting tool steel — and a good one — to punch a hole that's smaller in diameter than the thickness of the steel. And in this case the steel plate is twice as thick as the width of the ¾-in.-square hole.

The first few punches made from Omega averaged well over 100 holes. So they made up 102 Omega punches and used them on a production basis. These produced 2 holes each in 18,160 plates — an average of 356 holes per punch, and more than 5 times the service life of the steel previously used.

This is another example of the way Omega can master heavy-shock applications. It's been doing a fine job for years on such tools as: pneumatic chisels, pawls, punches, knockout pins, swaging dies, shear blades, clutch and machine parts.

Omega is tops for cold-shock jobs. Your Bethlehem tool-steel distributor carries Omega in his stock for fast delivery. Its typical analysis:

C	Mn	Si	Mo	Va
.60	.70	1.85	.45	.20

⬅ Blanking High-Carbon Sheets

The excellent shock-resisting properties of our 67 Chisel make it a good choice for the blanking of clutch-plate discs from .09-in., high-carbon sheet steel. Operating in a 350-ton press, this die produces about 30,000 pieces before any redressing is needed. The die is hardened to Rockwell C-53.

Despite its reputation for shock applications, 67 Chisel has plenty of wear-resistance for blanking tools, punches, swaging dies, hot-work tools, shear blades and master hobs. It's easy to carburize 67 Chisel whenever extra wear-resistance is needed . . . without sacrificing its tough core.

Stocked by Bethlehem tool steel distributors, 67 Chisel is easy to machine and heat-treat. Its typical analysis:

C	Si	Cr	W	V
.50	.75	1.25	2.50	.20

Dies That Hold Their Size

Being machined is a piece of Lehigh H for a progressive die that will blank, form and draw a precision part from 3/16-in. steel strip. When you machine a piece of our Lehigh H tool steel you can be sure that it's going to hold those accurate dimensions during heat-treatment. Distortion and warpage are held to the very minimum.

This high-carbon, high-chromium grade is also first choice for long wear and high compressive loads. And because Lehigh H is air-hardening there's little chance of quenching-cracks, even when dies have intricate designs.

Lehigh H is stocked in many sizes by Bethlehem tool steel distributors everywhere. Its typical analysis:

C	Cr	Mo	V
1.55	11.50	.80	.40

BETHLEHEM TOOL STEEL ENGINEER SAYS:

It's better to grind round tool steel bars than to cold-draw them.

Because tool steel is inherently hard and brittle, it's ordinarily best not to specify that it be furnished in the cold-drawn condition. When very close size-tolerances are required, round bars are sometimes cold-drawn.

However, cold-drawing does *not* remove minor surface defects or decarburization. The surface of a cold-drawn bar must be machined off — just as with a hot-rolled bar — before tools are heat-treated. Otherwise, tools may crack in heat-treatment and will have a soft "skin."

It's better to finish round bars by centerless grinding, because the grinding does remove minor surface defects and decarburization. Tools can be made from ground bars without first machining off the surface.

Tool steel in sections other than round must usually be furnished cold-drawn if tolerances have to be close, because such sections as flats and squares cannot be surface-ground economically.

This is an APEX tool.....

A socket—measuring 11″ in diameter, 8⅞″ in overall height, to drive 7⅝″ hex nuts.

An extension—measuring 3½″ in diameter, 30″ in overall length, with 2½″ male and female square drive.

This special Apex socket and extension is to be driven by a new power tool designed to develop 3,000 to 6,000 ft./lbs. of torque.

We're quite sure you can't use this particular Apex tool in your plant, but it's an interesting example of our ability to furnish an effective answer to just about any nutsetting problem.

AND THESE ARE APEX TOOLS . . .

Most likely, the answer to your nutsetting problems will be found among the more than 5,000 stock types and sizes of Apex nutsetting tools. If not, just send us a sketch or blueprint and we'll do our best to furnish a special answer . . . we'll quote promptly, without obligation.

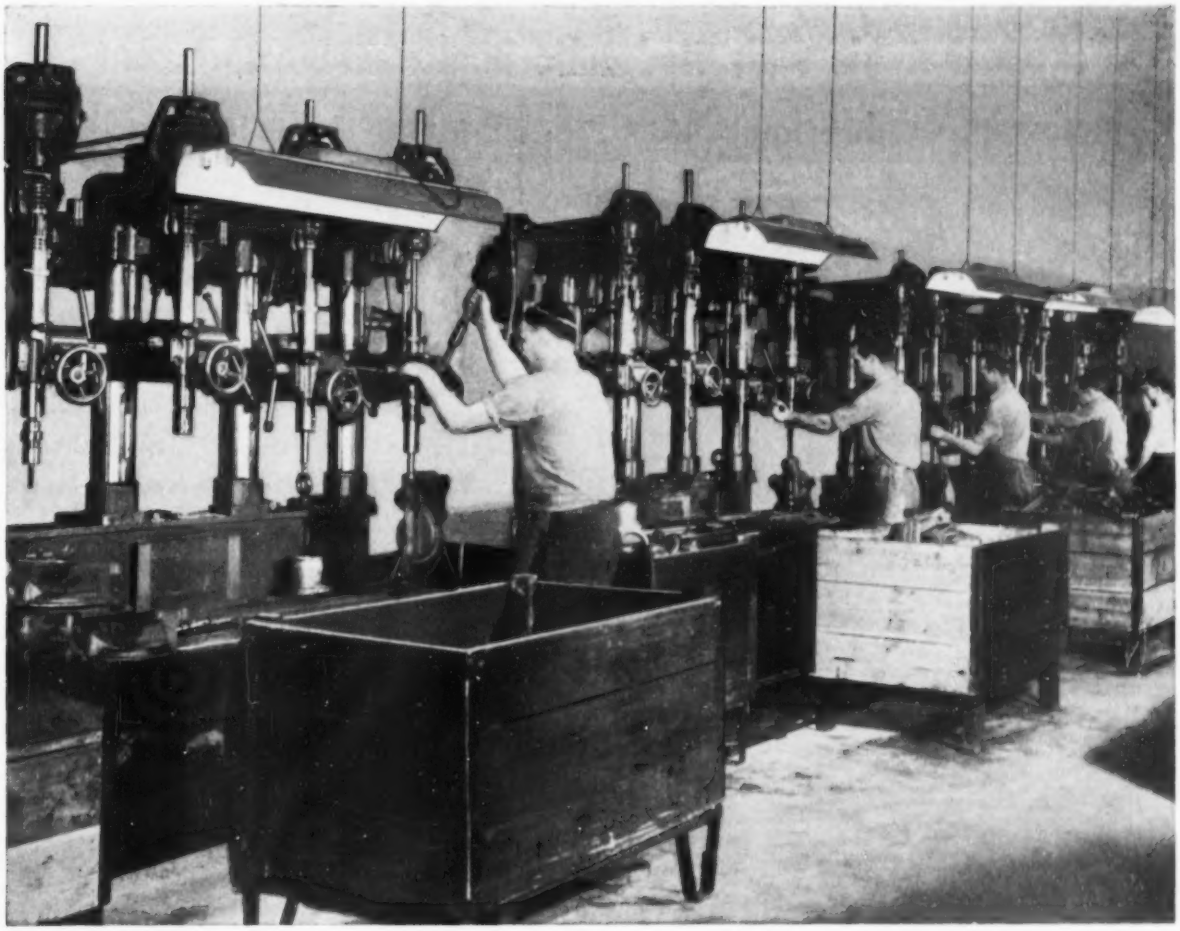
CATALOG 29

122 pages of helpful information on Apex sockets, extensions, adapters, straight wrenches and universal sockets and wrenches. Write, on your company letterhead please, for your copy.

APEX TOOLS

THE APEX MACHINE & TOOL COMPANY

1026 S. Patterson Blvd., Dayton 2, Ohio



EASY WAY TO HIT PEAK PRODUCTION!

In this well-known meter plant, as in hundreds of efficient shops, they're jacking up drilling output this simple way: instal! the easy-handling multiple spindle "Buffalo" Drills your operation requires. You not only eliminate waste setup motions, but you get better accuracy, less worker fatigue and longer drill life.

In the photo above, the men on the four-spindle "Buffalo" No. 22 Drills are able to set up as many as four different drilling, tapping and reaming operations. Production flows right down the line easily and with minimum delays between operations. All controls and adjustment cranks are easily reached, so that these large-capacity machines are as easy to handle as smaller sensitive drills. Let us recommend a drilling arrangement to help cut *your* drilling time and cost!

DIAMOND JUBILEE 75TH ANNIVERSARY

"Buffalo" MACHINE TOOLS

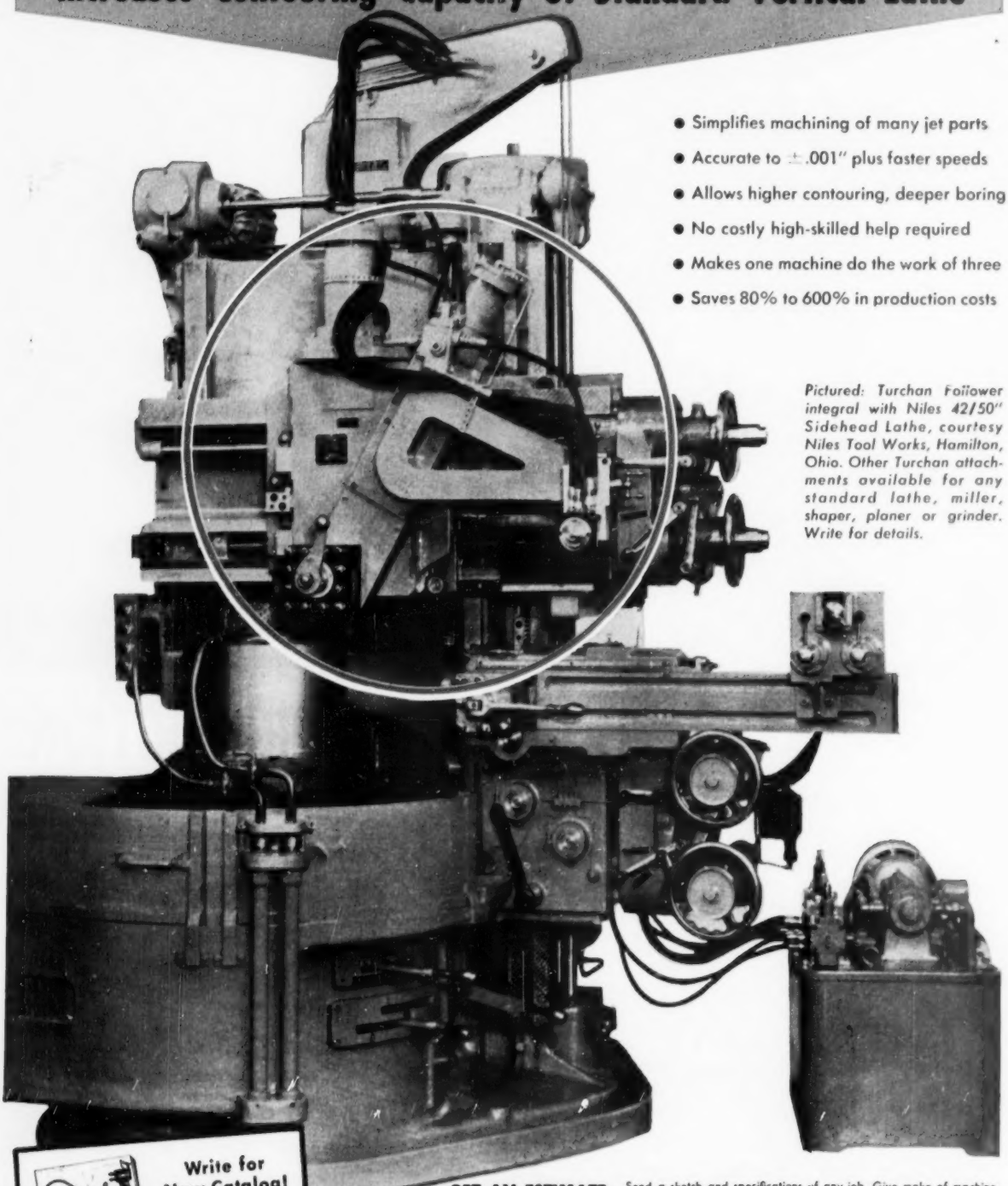
BUFFALO FORGE COMPANY

509 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

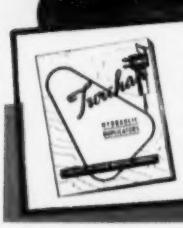
DRILLING PUNCHING SHEARING CUTTING BENDING

Turchan Angle Slide Hydraulic Duplicating Attachment Increases Contouring Capacity of Standard Vertical Lathe



- Simplifies machining of many jet parts
- Accurate to ±.001" plus faster speeds
- Allows higher contouring, deeper boring
- No costly high-skilled help required
- Makes one machine do the work of three
- Saves 80% to 600% in production costs

Pictured: Turchan Follower integral with Niles 42/50" Sidehead Lathe, courtesy Niles Tool Works, Hamilton, Ohio. Other Turchan attachments available for any standard lathe, miller, shaper, planer or grinder. Write for details.



Write for New Catalog!

Tells how to get more and better work from your present machines, without skilled help and special tools.

GET AN ESTIMATE: Send a sketch and specifications of any job. Give make of machine. We'll show you how to produce it better, faster, at lower cost.

Turchan FOLLOWER MACHINE COMPANY

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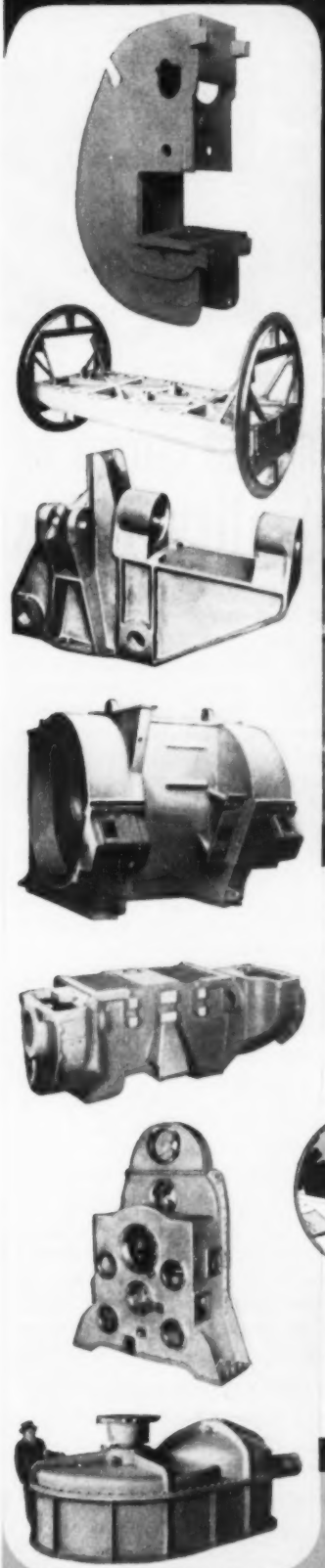
Steel-Weld FABRICATION



Use WELDED STEEL for Greater Strength with Less Weight!

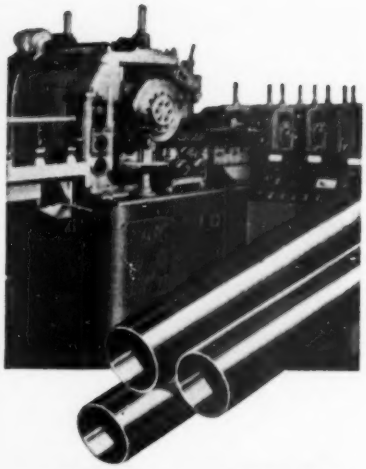
In the illustration above you see a portion of the Mahon machine shop where welded steel parts and assemblies of various sizes and weights are machined to specification for many industries throughout the country. Facilities are available right in the Mahon plant to do the complete job from the drawing board to finished machining ready for assembly. If you have parts or assemblies that can be redesigned and produced to better advantage through Steel-Weld Fabrication, or, if you are faced with a production problem involving large heavy pieces in which pattern costs are a consideration, you can turn to Mahon with complete confidence. You will find in the Mahon organization a unique source with complete, modern fabricating, machining and handling equipment to cope with any type of work regardless of size or weight . . . a source where skillful designing and advanced fabricating technique are supplemented by craftsmanship which assures you a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Mahon's Insert in Sweet's Product Design File, or write for further information.

THE R. C. MAHON COMPANY

DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON



HIGHEST OUTPUT OF Quality Tubes

● Most manufacturers, when investing in an electric-weld tube mill, do so only after careful investigation, especially of performance records. Where, as often happens, records are available of the output and scrap losses of different mills, making comparisons possible, the choice of a Yoder is never in doubt. As a result, since their introduction in 1938, more Yoder mills have been installed in the U.S.A. and many foreign countries than electric-weld mills of all other makes combined.

In fact, the high quality and economy of tubing made in Yoder mills, have powerfully stimulated consumption and multiplied the uses for electric-weld tubing in the automotive, electric appliance, metal furniture and other mass production industries. The supply of such tubing, therefore, has never caught up with the demand.

Get the facts about Yoder mills, incorporating the latest developments in tube making, including the revolutionary new Yoder induction high speed welders for *non-ferrous as well as ferrous metals* and alloys.

THE YODER COMPANY
5519 Walworth Ave. • Cleveland 2, Ohio

Resistance Weld TUBE MILLS

ENGINEERING YODER MANUFACTURING

From the *American Machinist* Library of *Tips for Top Shop Men*

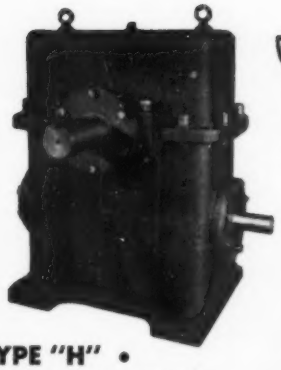
DON'T flaunt your greater income or privileges before your subordinates. No matter how much they like you, their resentment and envy will do you more harm than the flaunting does your ego good.

REMEMBER that human problems need careful study just as do engineering problems. Man is multi-motivated and one prescription won't cure all his ills.

BE suspicious of any figures you hear, and of most of those you see. If they don't correspond immediately to your previous experience, check 'em before you quote or use 'em. The urge to make numbers bigger, or smaller than anything previously reported is overpowering to some people; don't be victimized.

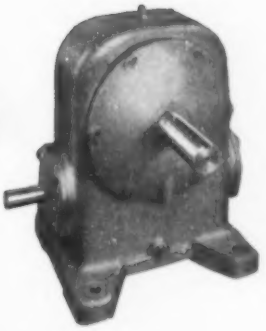
D.O.James

ESTABLISHED 1888



TYPE "H" •

Horizontal or Vertical Drive—Each drive type comes in 15 sizes, with ratio ranges of 5.6:1 to 100:1 and from .06 to 206 horsepower.



TYPE "S" •

Horizontal or Vertical Drive—Each type available in 8 sizes, ratio range of 5.66:1 to 100:1 and from .04 to 15.6 horsepower.

for the Best in

WORM GEARS AND WORM GEAR REDUCERS

MOTORIZED •

Horizontal or Vertical Drive—Each drive type comes in 11 sizes, has ratio range of 5.6:1 to 100:1, with ⅛ to 30 horsepower, driven speeds of 310 r.p.m. to 17.4 r.p.m. Vertical drive slow speed shaft extends either upward or downward.

DOUBLE •

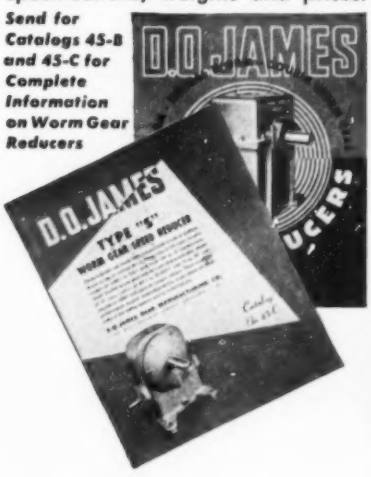
Horizontal or Vertical Drive—Each drive type available in 13 sizes, ratio range of 130:1 to 10000 and from .004 to 59.7 horsepower. Vertical drive slow speed shaft extends either upward or downward.

WORM GEARS

Generated on tangential feed hobbing machines by tapered and ground hobs. Made from 1" to 100" in diameter and from 24 DP to 1 DP.

Catalogs are available to users of Gears and Gear Reducers—containing valuable engineering data, specifications, weights and prices.

Send for Catalogs 45-B and 45-C for Complete Information on Worm Gear Reducers



D. O. JAMES Worm Gears and Worm Gear Reducers are designed and manufactured to have maximum inbuilt strength and to assure dependable *on-the-job* performance. The many and repeated installations of these reducers testify to their operating superiority and adaptability.

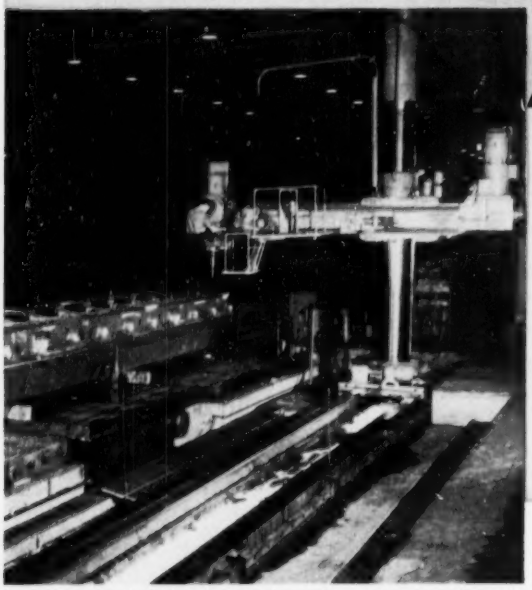
D.O.James GEAR MANUFACTURING COMPANY

1140 WEST MONROE STREET • CHICAGO, ILLINOIS

SINCE 1888—MAKERS OF ALL TYPES OF GEARS AND GEAR SPEED REDUCERS

Kaukauna DRILLING and TAPPING Machines

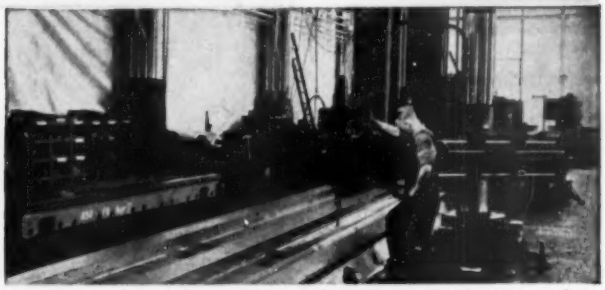
UNIVERSAL AND HORIZONTAL



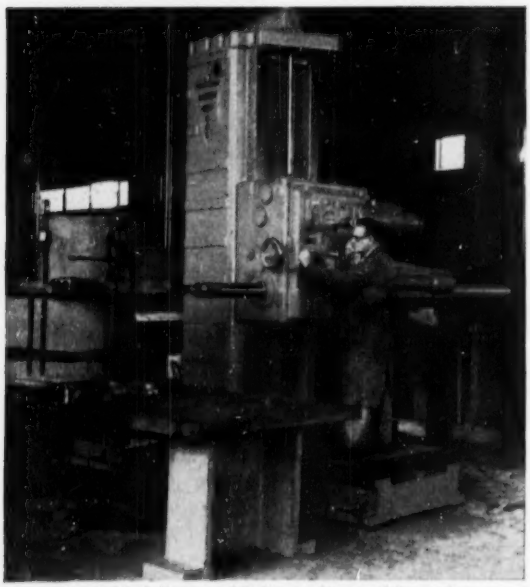
Special Model 140-U with extended column, runway, and reach—for drilling Diesel Engine bases and blocks.

PROFIT FROM ANGULAR, VERTICAL AND HORIZONTAL OPERATIONS WITH 1 SETUP

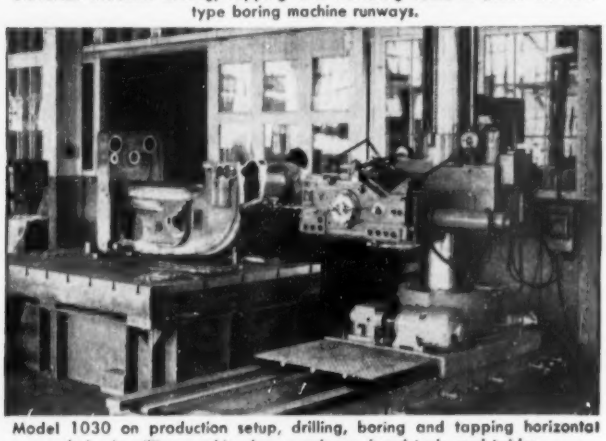
Almost any casting or weldment—of almost any size and shape—can be drilled, tapped or spot-faced in any location accurately, quickly and easily with a KAUKAUNA Machine. Furnished with Universal Head with compound swivels, Tilting Head or Horizontal Head, all with 360° column swivel. Horizontal traverse on runway and vertical traverse on column to suit requirements.
For portable or fixed location use.



Universal Machine drilling, tapping and doweling racks in place on floor type boring machine runways.



Model 3040 Horizontal Drill—machining all four sides of rail slide casting.



Model 1030 on production setup, drilling, boring and tapping horizontal holes in milling machine bases, columns, headstocks and tables.

Cut your costs on setup time, crane time, fixturing and machine hours. *Write for Catalog.*

KMC

Kaukauna MACHINE CORPORATION

KAUKAUNA, WISCONSIN, U. S. A.

Croblox

(CHROME CARBIDE)

It's New!
Superior Corrosion Resistance!
Expansion Similar to Steel!

WRITE FOR FOLDER

Webber
GAGE BLOCKS

Largest exclusive manufacturer of ...

WEBBER GAGE COMPANY
12901 Triskett Road, Cleveland 11, Ohio

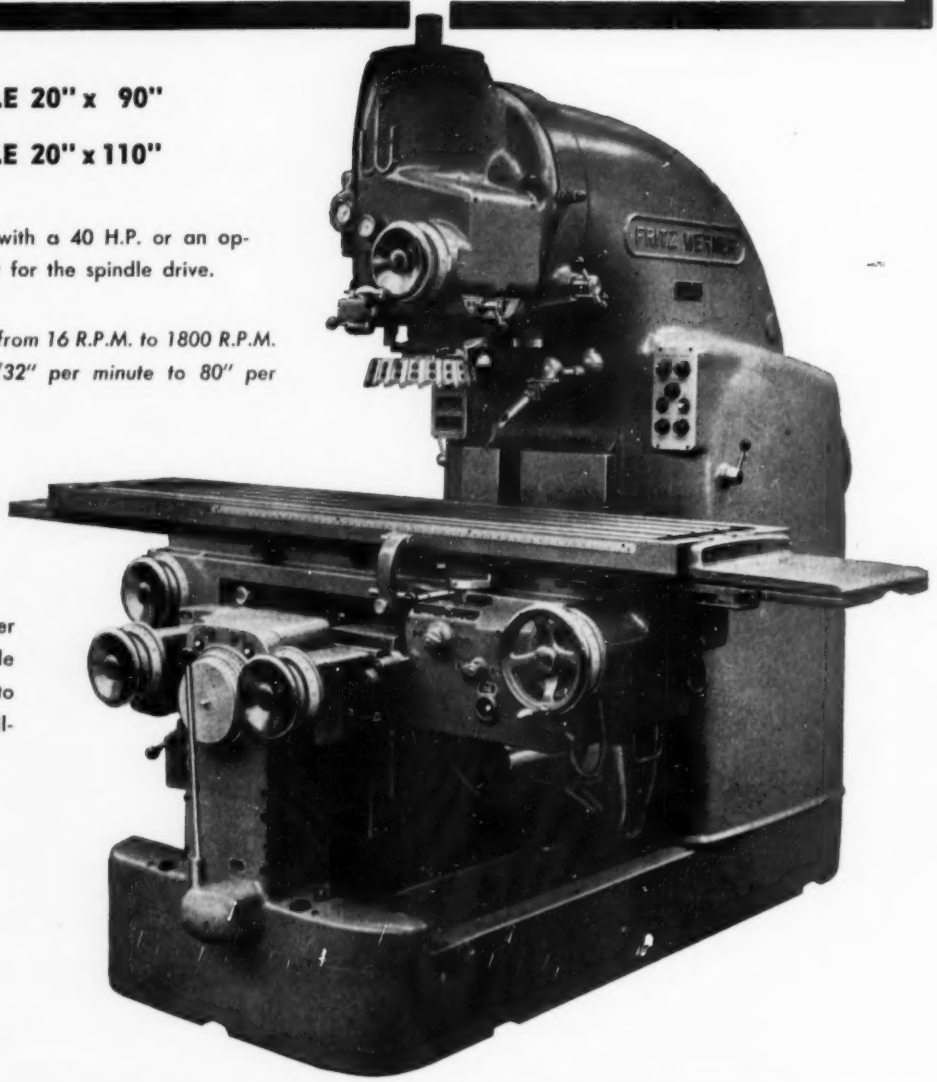
WERNER #5 and #6
VERTICAL MILLERS

#5 TABLE 20" x 90"

#6 TABLE 20" x 110"

Both are equipped with a 40 H.P. or an optional 50 H.P. motor for the spindle drive.

Spindle speeds range from 16 R.P.M. to 1800 R.P.M. Feeds range from 9/32" per minute to 80" per minute.



Werner Millers in smaller sizes from 0 to 4 with table sizes from 6" x 20" up to 16" x 72" are also available.

PROMPT & REASONABLE DELIVERIES

For further information Write, Wire, Phone

MARAC MACHINERY CORP. 1819 BROADWAY, N. Y. 23, CI 7-2048

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TYPE 430 STAINLESS STRIP STEEL

The luster of Superior 430 Stainless Strip Steel conveys more than sparkling beauty in the bathroom. Its brilliance speaks of triumph over rust and corrosion, where dampness and moisture abound. • Superior 430 Stainless Strip Steel is your ideal choice for fixture fabrication. Its *work-ability* is outstanding. Its brilliant luster, ease of cleaning and strength in service are most desirable sales advantages.

Superior Steel
CORPORATION
CARNEGIE, PENNSYLVANIA

Do you have a tough moisture-corrosion problem?

Our 430 Stainless is available in easy-handling coils. Let us serve you!

This Size . . . .

or This Size . . . .

with all "kinds of sizes" in between

SKF's wide range of bearing types and sizes, plus helpful SKF engineering cooperation, makes it possible for you to select the bearing whose characteristics make it the best bearing choice for your particular application.

SELF-ALIGNING BALL BEARINGS

Compensate for angular misalignment resulting from faulty mounting, shaft deflection or distortion of the foundation. For radial loads and moderate thrust loads in either direction.

SPHERICAL ROLLER BEARINGS

Unexcelled for capacity. Inherently self-aligning. The full capacity of the bearing is always available for useful work. Will carry substantial thrust load in either direction.

DOUBLE-ROW DEEP GROOVE BALL BEARINGS

Embody the same design principle as the single-row type, but have lower axial displacement and substantial thrust capacity in either direction. Have very high radial capacity.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Sustain, in addition to radial load, substantial thrust load in either direction even at high speeds. Available with famous Fairprene Red Seals which keep dirt out and lubricant in. Also with any combination of Red Seals, shields, and snap-rings. Furnished in standard or precision tolerances.

ANGULAR CONTACT BALL BEARINGS

Support heavy thrust load in one direction, sometimes combined with moderate radial load. Can be mounted singly or in tandem for constant thrust load in one direction; also in pairs, face-to-face or back-to-back, for combined thrust and radial loads.

CYLINDRICAL ROLLER BEARINGS

Very high radial capacity and low friction which permits high-speed operation. Easy to dismount, even when both rings are mounted with a tight fit.

BALL THRUST BEARINGS

For pure thrust load in one direction only. Not self-aligning. The load line through the balls is parallel to the shaft axis, resulting in high thrust capacity and minimum axial deflection.

SPHERICAL ROLLER THRUST BEARINGS

For heavy thrust loads, or combined loads which are predominantly thrust, at high speeds on vertical or horizontal shafts. Fully self-aligning.

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BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

– manufacturers of **SKF** *and* HESS-BRIGHT *bearings.*

7388

ARO AIR TOOLS HELP GILLETTE GET SUPER-SPEED PRODUCTION

SCREW-DRIVING. Aro Screwdriver, Model 7329-R, in special fixture made by Gillette to hold the Super Speed Razor during assembly of handle. Foot treadle actuates throttle. Aro's torque control very important here—drives screw to just-right tightness!

GRINDING. Aro Grinder, Model 7014, used by Gillette in preparing blade stock for processing in a continuous strip, coiled on reels.

Millions of Gillette Super Speed Razors have been assembled during the past five years with the help of ARO Air Tools.

Perhaps ARO can help you speed up production and cut costs in drilling, grinding, polishing, screw driving and other operations.

An ARO Field Engineer will gladly help in engineering your job or *contact your Aro distributor.*

The Aro Equipment Corp., Bryan, Ohio
Aro Equipment of Canada, Ltd., Toronto, Ont.

The Leader! **ARO AIR TOOLS**

Also . . . LUBRICATING EQUIPMENT . . . HYDRAULIC EQUIPMENT . . . AIRCRAFT PRODUCTS . . . GREASE FITTINGS

production begins with

Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

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ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

YESTERDAY'S PIONEER . . . TODAY'S LEADER

HERE'S A SINGLE ORDER—
48 Large Special
WELDON End Mills

The 48—*Count 'Em!*—48 special large WELDON end mills above represent a single order shipped to one of our enthusiastic customers. These are special husky, fast metal-removing WELDON end mills built for sturdy dependable service.

This customer orders in lots like this because he realizes that his profits depend in part on the use of WELDON end mills, noted for their quality, accuracy and fast-cutting performance.

Weldon Distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY
3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

"This judge is a stickler for precision. His plant is packed with

Logan LATHES!"

Logan 940-2
QUICK CHANGE GEAR TURRET LATHE
11" Swing, 1" Collet Capacity,
1⅜" Spindle Hole

PRECISION MINDED JUDGES of lathes are selecting more Logans every year for production, shop and tool room work. They like the sustained accuracy of the Logan ball bearing spindle that needs no adjustment for any speed from 45 to 1500 rpm. They like the rugged, accurate warp-free Logan bed with two V-ways and two flat ways precision ground to a tolerance of .0005". They approve the 11" swing, 1" collet capacity and 1¾" spindle hole that provide capacity for most of any shop's metal turning. They keep in mind the fact that no other lathe of comparable specifications can match the Logan in economy.

See your Logan Dealer or Write for the Logan Lathe and Shaper Catalog

LOOK TO LOGAN FOR BETTER LATHES AND SHAPERS

LOGAN ENGINEERING CO.

4901 West Lawrence Avenue, Chicago 30, Illinois

You Spent at least $6,000 to create his job... will you spend $2.30 to Protect it?

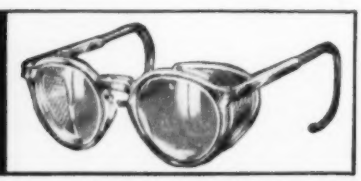
Eye Accidents Cost $176,000,000 a year in LOST MAN-HOURS alone*

To give a skilled worker the tools and machines to produce, industry invests $6,000 or more per job. If you lose his skill due to an industrial eye accident, you tie up your $6,000 completely if he has no adequate substitute. You lose the production his tools turn out. And if his is a critical "bottleneck" operation, you may tie up entire plant output.

Even a production *slowdown* is grim business in these days of high break even points. Why risk it because of a costly eye accident, when the average cost of a pair of safety goggles that can prevent his eye accident is only $2.30? Call your nearest AO Branch Office and learn how an AO Eye Protection Program can save money well into four figures annually.

*Estimate. Industrial eye injuries cost over $5 per employed worker per year—with compensation averaging nearly $400 per injured man.

American Optical Company
SAFETY PRODUCTS DIVISION



Write American Optical Company, 5133 Vision Park, for free booklet "Improved Industrial Vision" telling how AO's Industrial Vision Program cuts costs, increases production, decreases accidents.

SOUTHBRIDGE, MASSACHUSETTS

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THE AMAZING NEW STEEL HARDENING COMPOUND

"ARMOR-TUF hardens tools and steel parts as easily as baking pie, and much more quickly."

Now used by leading steel processors and other manufacturers everywhere!

You can use milder, cheaper steels for many applications and machine them before hardening. The saving is two-fold: less expensive steels and lower machining costs. ARMOR-TUF gives low carbon steels the cutting and wearing properties of tool steels. You can harden the softest steels to a degree ordinarily obtainable only in high priced steels.

Service between sharpenings increased 10 times and more. Tools hardened with ARMOR-TUF hold their edges many times longer. The advantages: substantially reduces resharpening costs . . . saves on time lost changing dull tools . . . keeps tools in service . . . enables increased production as result of less frequent tool changing and sharpening.

As compared with the usual heat treating processes, the saving in time is great. Instead of hours, only minutes are needed. The entire hardening process takes less than ten minutes.

No CYANIDE, Absolutely — ARMOR-TUF is safe to use, contains no cyanide of any kind — there are no toxic fumes.

ARMOR-TUF IS UNCONDITIONALLY GUARANTEED TO INCREASE THE LIFE OF TOOLS AT LEAST 300%, OR YOUR FULL PURCHASE PRICE WILL BE REFUNDED.

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Many years of scientific research, valuable experience and engineering knowledge have dictated the perfected designs and proper materials now incorporated in the complete line of Whitman & Barnes drills. There are individual drill designs and materials for producing best possible results when drilling ferrous and non-ferrous metals, plastics, glass, wood, stone, etc.

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"Makers of Fine Tools Since 1848"

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Here's Proof

The New Thompson Type 2F is a

SUPER PRECISION

Tool Room Grinder

WEBBER GAGE COMPANY
12900 TRISKETT ROAD · CLEVELAND 11, OHIO

November 10, 1950

Mr. Wilson, Vice President
Thompson Grinder Company
Springfield, Ohio

Dear Mr. Wilson:

We recently installed a new THOMPSON Tool Room Grinder to grind Gage Blocks to our specifications and tolerances. The results have been very satisfactory, in spite of the close limits to which the work has to be done. We thought you would be interested in the performance of this machine.

Very truly yours,
WEBBER GAGE COMPANY
George D. Webber

Thompson 2F Grinder Photographed in the Webber Gage Co., Cleveland Plant

COMPARE THIS NEW 8 x 10 x 24 TOOL ROOM GRINDER

When working to a tolerance of four millionths of an inch such as is observed when making Webber Gage Blocks, the rough or preliminary grinding plays an important role in keeping cost of the final finishing within reasonable limits.

Compare These Features:

- HARDENED AND GROUND cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- HARDENED AND GROUND sealed anti-friction vertical slide.
- HARDENED AND GROUND BED WAYS with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.

Handy control panel.

- Elevation micrometer stop graduated in .0001".
- GROUND THREAD FEED SCREW.
- Automatic wheel TRUING device.
- Longitudinal hand wheel with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".
- GROUND THREAD FEED SCREW.

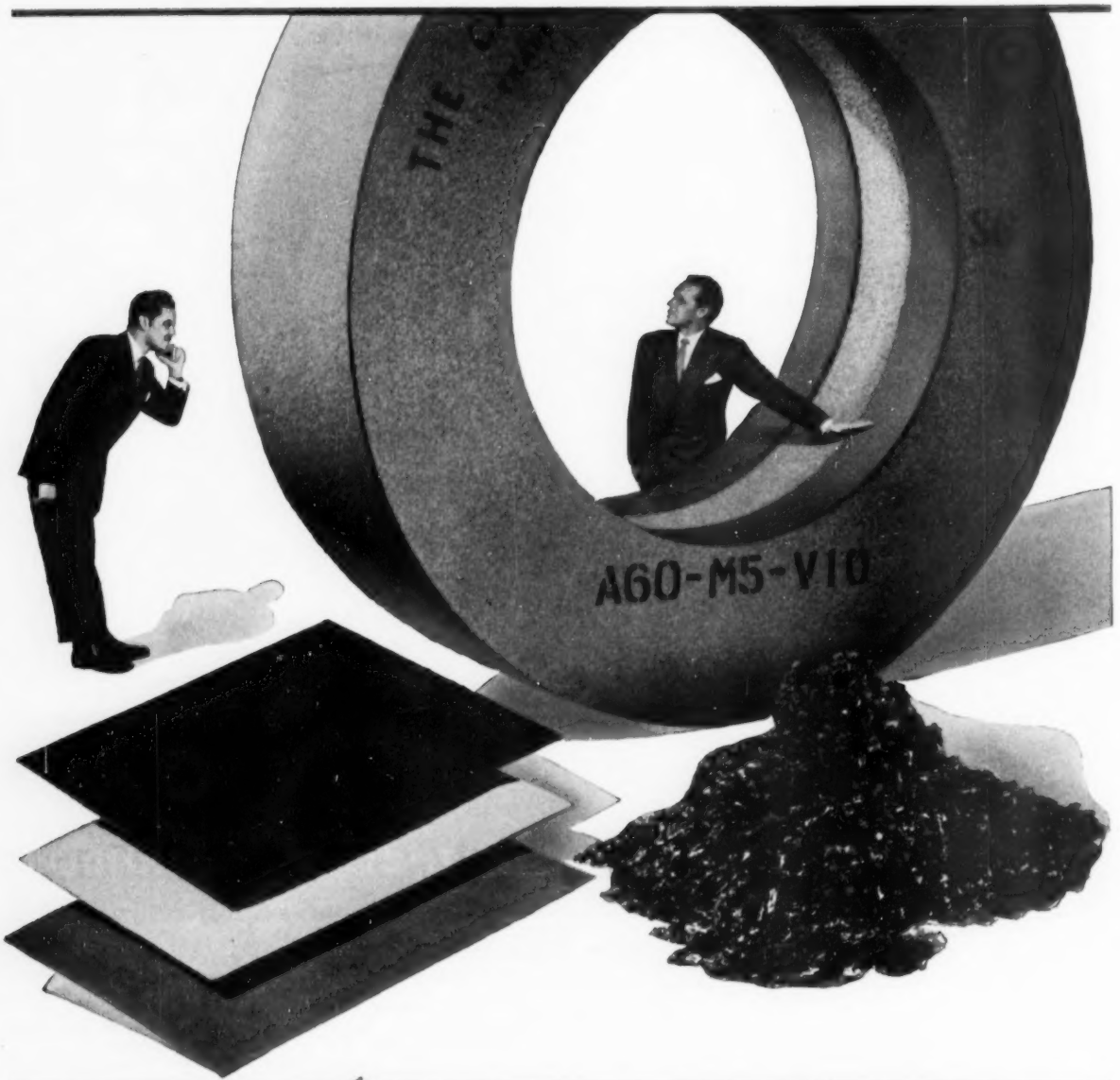
WRITE TODAY for complete specifications and performance data. Address Dept. 16, Thompson Grinder Co., Springfield, Ohio.

The only manufacturer of a complete range of heavy duty and light duty surface and contour grinders for industry.

Thompson SURFACE Grinders

The Thompson Grinder Company, Springfield, Ohio

What's BEST FOR



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TRADE

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YOU is BEST for us!

You get UNBIASED COUNSEL based on all abrasive methods

Your business, in mass production of parts or finished assemblies, is the problem of generating close tolerance sizes, of producing high surface finishes, of removing stock. The business of CARBORUNDUM is the exclusive ability to recommend and furnish you the specific type of abrasive product which will give you highest quality at lowest cost, on every operation you perform.

Take surfacing, for instance. There are at least 11 different methods of grinding plane or flat surfaces with abrasives. Is your present method the best—the most economical? How can you be sure? Ask CARBORUNDUM . . . for CARBORUNDUM alone has a complete branded line of grinding wheels *and* coated abrasives *and* tumbling and polishing grains. Only CARBORUNDUM can recommend without bias, on the sole basis of what's best for you.

Or perhaps you manufacture table glassware. You can engrave the decorations with a grinding wheel—or you can etch them with high-velocity abrasive grain. You can finish the edges with abrasive belts, or with a grinding wheel. Whatever your method, CARBORUNDUM alone can supply *all* the abrasives you need with *one-source control* of quality . . . quality that's constant, identical, dependable—thus economical.

Several ways to do one operation? Call in CARBORUNDUM. Several processes on one part? Call in CARBORUNDUM. Either way, you win.

Call your CARBORUNDUM *Salesman or Distributor* today!

He's your best bet for complete stocks, prompt delivery . . . and best of all, experienced counsel on *every* new development in the *entire* field of abrasives. He's in the yellow pages under "Abrasives" or "Grinding Wheels." Phone him today—it's to your profit!

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Our vastly increased production facilities mean quickest deliveries in the industry.

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Constant research and improvement make these wheels the world's finest.

at competitive prices

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RESINOID BONDED WHEELS
for continuous fine performance

. . . rapid stock removal . . . no carbide ruined by heat checks . . . perfect "spark-out" on large diameter cutters . . . keen cutting edges . . . maximum economy in terms of carbide removed per dollar of wheel cost.

Continuous research and improved manufacturing methods have resulted in the finest Diamond Wheels for production maintenance of all carbide cutting tools, milling cutters, dies, etc.

Model CH-105 Carbide Tool Grinder gives the low tool maintenance cost small shops demand and large plants need. Equipped for wet grinding. 9000 RPM spindle gives higher surface speed to smaller, less expensive wheels making them cut much faster and perform more efficiently.

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AURORA, ILLINOIS

"American made for American industry"

EFFICIENT CUTTING...
LONG BLADE LIFE...
plus at least
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VICTOR "Moly"® High Speed Power Blades

Do your toughest metal cutting jobs efficiently, economically and *right* with VICTOR "Moly" High Speed Power Blades.

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INDUSTRIAL DISTRIBUTOR

VICTOR "Moly" High Speed Power Blades are sold only through recognized distributors—the men you know and have confidence in, the men who have stocks on hand to give you fast service when and where you want it. You're wise to buy whatever you can from your recognized distributor.

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Makers of Hand and Power Hack Saw Blades, Frames and Metal Cutting Band Saw Blades

From the *American Machinist* Library of *Tips for Top Shop Men*

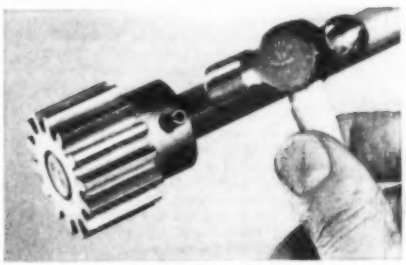
GET to know your people *before* you have to get tough with 'em. It's poor policy to make their acquaintance by bawling 'em out. Introduction by insult is no longer a successful management routine.

THE old Army slogan, "If it moves, salute it; if it doesn't, pick it up; if you can't pick it up, paint it," can well be adapted for plant use by changing "salute" to "guard" and "paint" to "oil."

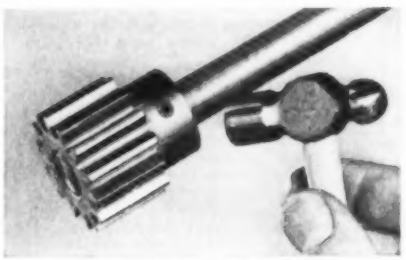
Where can you use this simple fastener?

No threading, peening or precision drilling with ROLLPIN

Rollpin is driven into holes drilled to normal production-line tolerances.



It compresses as driven.



Rollpin fits flush . . . is vibration-proof.

Rollpin is the slotted tubular steel pin with chamfered ends that is cutting production and maintenance costs in every class of industry.

This modern fastener drives easily into standard holes, compressing as driven. Its spring action locks it in place—regardless of impact loading, stress reversals or severe vibration. Rollpin is readily removable and can be re-used in the same hole.

* * *

If you use locating dowels, hinge pins, rivets, set screws—or straight, knurled, tapered or cotter type pins—Rollpin can cut your costs. Mail our coupon for design information.

Elastic Stop Nut Corporation of America
Dept. R16-39, 2330 Vauxhall Road, Union, N. J.

Please send me the following free fastening information:

☐ Rollpin bulletin

☐ Elastic Stop Nut bulletin

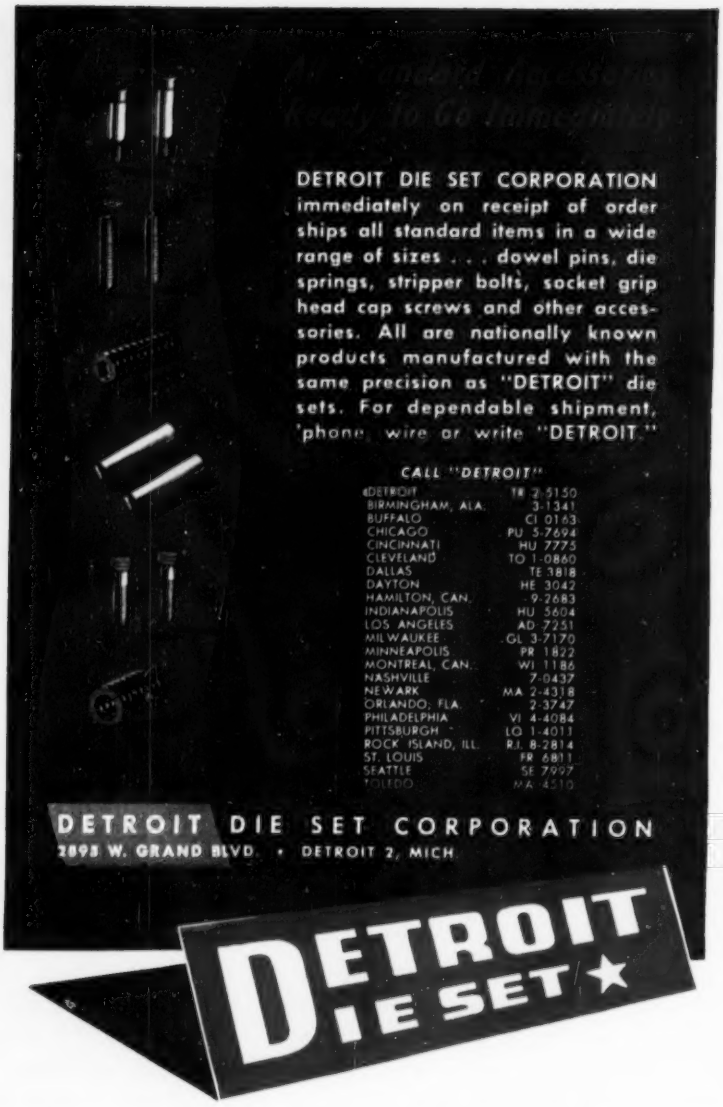
☐ Here is a drawing of our product. What fastener would you suggest?

Name _____ *Title* _____

Firm _____

Street _____

City _____ *Zone* _____ *State* _____



DETROIT DIE SET CORPORATION immediately on receipt of order ships all standard items in a wide range of sizes . . . dowel pins, die springs, stripper bolts, socket grip head cap screws and other accessories. All are nationally known products manufactured with the same precision as "DETROIT" die sets. For dependable shipment, 'phone, wire or write "DETROIT."

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DAYTON	HE 3042
HAMILTON, CAN.	9-2683
INDIANAPOLIS	HU 5604
LOS ANGELES	AD 7251
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DETROIT DIE SET CORPORATION
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DETROIT DIE SET ★

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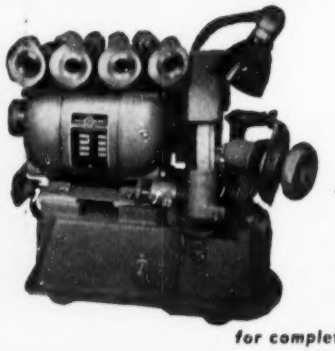


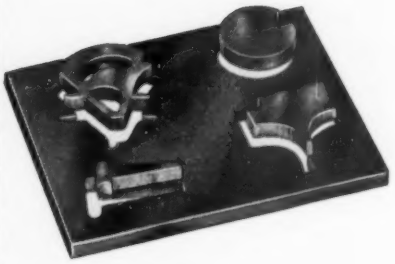
Black Diamond
PRECISION
DRILL GRINDER
for
SHARPENING SMALL DRILLS

- INDUSTRY'S FIRST CHOICE
- SIMPLE TO OPERATE
- PRECISION RESULTS
- LOW-PRICED

for complete details write to

BLACK DIAMOND SAW & MACHINE WORKS, INC.
NATICK, MASSACHUSETTS

Atlantic
CONTOUR BANDS



BUILT STRONGER-TO LAST LONGER!

Intricate curves call for more than a blade of flawless precision — complex contour cutting requires a band saw of lasting STAMINA! Teeth of maximum hardness . . . strong, yet flexible, stock . . . correct heat treating — all are essential in producing a contour band that not only cuts — *but keeps on cutting!* Atlantic saws are the production-increasing result of advanced design, materials and technical skills — Atlantic "extras" that payoff in production with more work per blade! . . slashed downtime! . . increased output! *Here is proof —*

Each tooth is scientifically heat treated from tip to gullet to a diamond-like hardness—an Atlantic assurance of a band of permanent set and durability. Atlantic's special analysis steel stock remains flexible! Blades are free from damaging checks and flaws — most costly blade breakage and crystallization is completely eliminated.

For 30 years Atlantic's facilities have been devoted exclusively to producing constantly improved blades. In the complete Atlantic line, there's a quality blade for every material, every job.

RAKER SET BANDS
An excellent blade for accurate, finished metal cutting.

WAVY SET BANDS
Slices bar stock, flat stock, tubing —whatever you want cut with new speed and economy.

SKIP TOOTH BANDS
The modern blade that cuts plastic, wood, soft metals with unrivaled efficiency and durability.

FREE!

Send today for the graphic story of Atlantic's family of fine saws. If you have a specific saw application you are wondering about, include a brief description — it will meet interested engineering attention and be promptly acknowledged.

Atlantic
ATLANTIC SAW MFG. COMPANY, Inc.
BREWERY STREET New Haven, Connecticut

For those . . .

UNUSUAL TAPPING OPERATIONS

USE S-J SCULLY-JONES

HEAVY DUTY TAP HOLDERS and CLOSE CENTER TAP DRIVERS

EASY TO HOLD AND DRIVE LARGE TAPS

These rugged, one-piece tap holders are widely used in radial drills, drill presses, turret lathes, horizontal boring mills and similar machines for heavy duty tapping operations.

The thick body wall takes a lot of punishment, yet is not oversize in relation to spindle diameter. Hole and shank are concentric within .002". The hole centers the shank of the tap, and a broached square furnishes a positive drive.

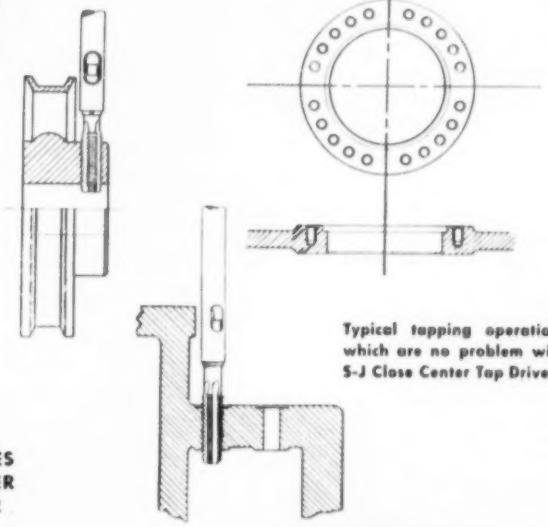
MAXIMUM CLEARANCE BETWEEN CENTERS

When tapping holes close together or near a shoulder, the S-J Close Center Tap Drivers will do the job. As they are smaller in diameter than machine spindles, they provide maximum clearance between centers.

The hardened, splined section furnishes a positive drive for the square of the tap. Collet action of the split bushing on shank of tap reduces strain, and cuts down tap breakage. As the tap works harder, bushing grips shank tighter. Three series—short, medium and long.

SCULLY-JONES HEAVY DUTY TAP HOLDERS

SCULLY-JONES CLOSE CENTER TAP DRIVER



Typical tapping operations which are no problem with S-J Close Center Tap Drivers.

Write for Bulletin No. 4-50
on Scully-Jones Tap Holders and Drivers.
Shows complete range of sizes, specifications and prices.

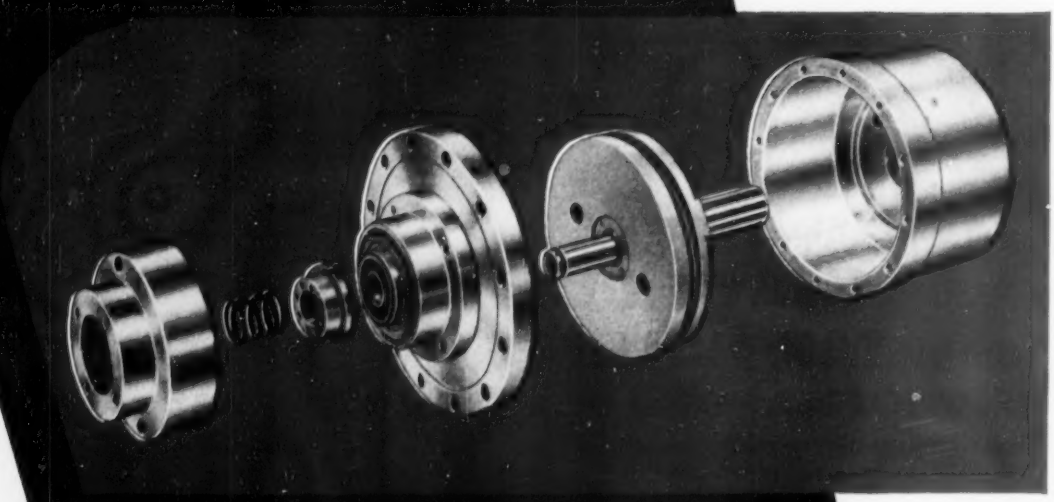
Scully-Jones AND COMPANY

1902 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

R-5673R

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

CUSHMAN



ALUMINUM AND IRON BODY AIR CYLINDERS

Simple, powerful, and trouble-free in operation, Cushman Rotating Air Cylinders set an entirely new standard for performance. Balanced and with few, rugged moving parts, they operate up to highest required speeds. Cushman engineers have also succeeded in perfecting the air control and power system to the point where applied pressures can be held dependable under production line operating conditions.

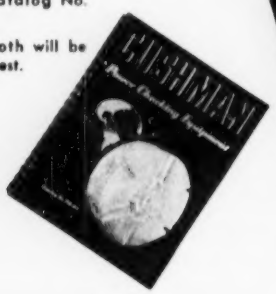
Any air chuck is completely dependent upon the efficiency of its operating air cylinder. Cushman Iron Body Rotating Air Cylinders have been designed to safeguard the performance of Cushman Precision Air Chucks, but may be used with other types too. Cushman Aluminum Body Rotating Air Cylinders provide equivalent performance at speeds up to the highest now being used. Low maintenance and long service life are inherent in this simplified design. Consult your distributor or write us direct for further information.

CONSERVE YOUR MAN-POWER

The Cushman Air Chuck Catalog No. PO-64-1952 covers our complete line of Air Chucks, Cylinders, and Accessories.

Cushman Manually Operated Chucks are separately described and listed in Catalog No. 65-1952.

Either or both will be sent on request.

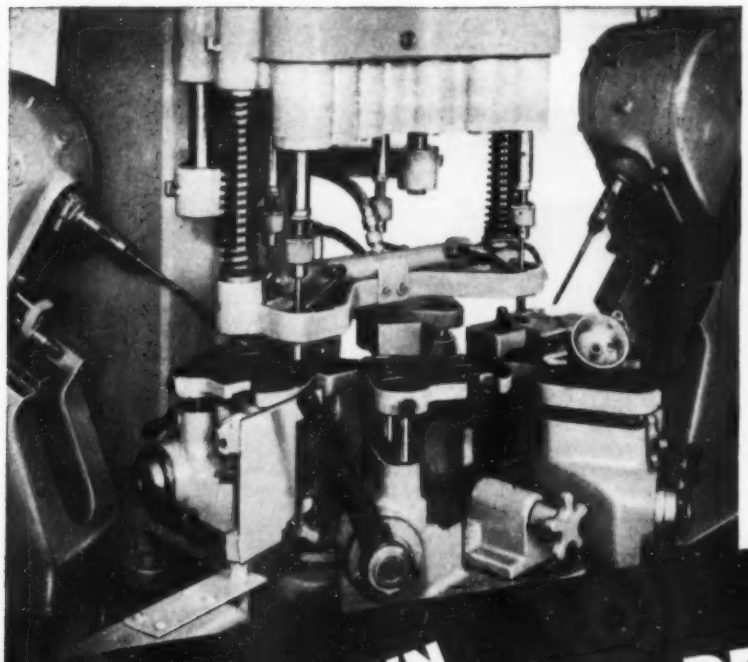


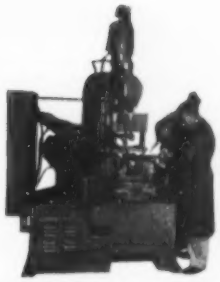
THE CUSHMAN CHUCK COMPANY
810 WINDSOR STREET,
HARTFORD 2, CONNECTICUT, U. S. A.
Chucking Engineers Since 1862

Manufacturers of
AIR CHUCKS, CYLINDERS, and ACCESSORY EQUIPMENT • THE CUSHMAN POWER WRENCH • CUSHMAN MANUALLY OPERATED CHUCKS and FACE PLATE JAWS.

A WORLD STANDARD FOR PRECISION

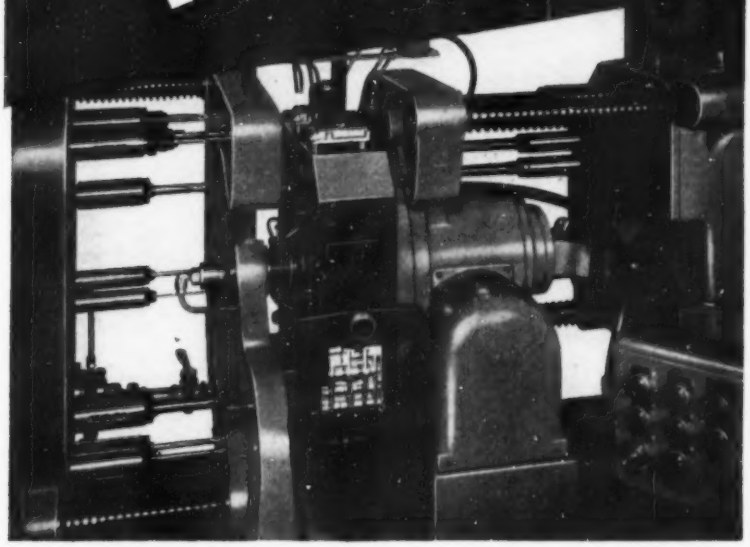
ac893

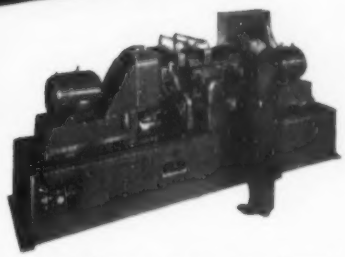




Closeup at the left shows a six station Hartford Automatic single purpose machine rough and finish reaming two cored holes, plus drilling two holes at different angles in die cast aluminum housings.

The LOWDOWN on HIGH PRODUCTION





This view shows a four station Hartford vertical dial type machine drilling, coredrilling and counterboring five holes in aluminum valve bodies.

Hartford Special is ready to design and build a special purpose drilling and tapping machine to boost your production, too. Why not write for more information.

When it comes to production –

HARTFORD *Special*

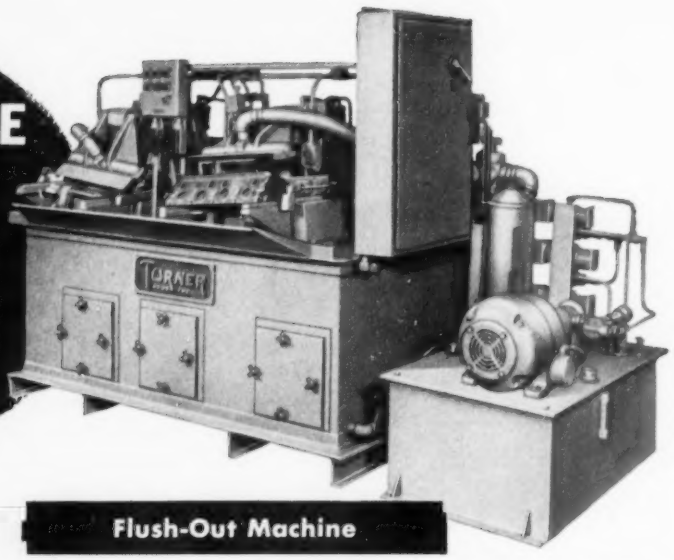
SUPER-SPACERS

Automatic THREAD ROLLERS

THE HARTFORD SPECIAL MACHINERY CO., HARTFORD 12, CONN.

NEED A SPECIAL PURPOSE MACHINE?

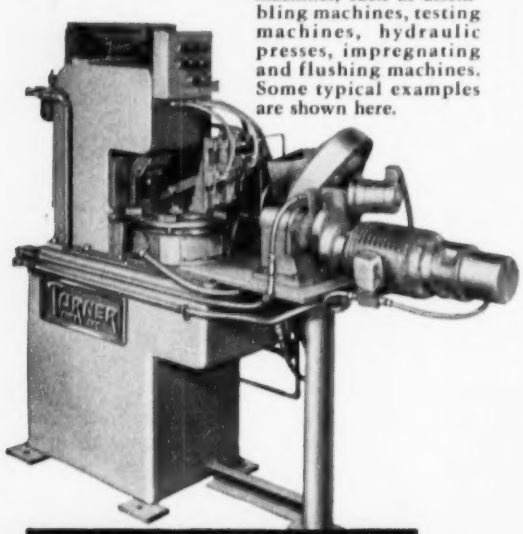
TURNER BROS. INC. DESIGNS AND BUILDS SPECIAL MACHINES TO HELP YOU *SAVE* ON MANPOWER, INSPECTION TIME AND FLOOR SPACE



Flush-Out Machine

Multiple cylinder head flush-out machine for testing and washing sand and chips from semi-machine cylinder heads. Cylinder head is placed in one side of machine, tripping limit switches, and when operator presses buttons, fixture closes, water pressure is automatically applied to fixture and forced into all openings that are not sealed in cylinder head. Water is flushed through all cavities in cylinder head for wash purposes. Pressure of water is equal to a 3" stream forced 90 feet into the air. During the sequence of this operation, operator is unloading and loading other fixture on machine. Note two palm buttons for operator safety.

Turner Bros. are primarily known for designing and building special indexing, transfer and trunnion type drilling, reaming, tapping and milling machines. They also design and build other types of special purpose machines, such as assembling machines, testing machines, hydraulic presses, impregnating and flushing machines. Some typical examples are shown here.



Automatic Drilling, Assembling and Crimping Machine

Machine designed and built by Turner Bros. for the automatic hopper loading of breather nut, insertion of baffle, crimping of baffle, drilling of nut, and automatic ejection.

50-Ton Hydraulic Precision Assembly Press

Hydraulic Assembly Press for accurately maintaining center distances in assembling inner portions of fluid coupling. The ram on this machine is set with an indicator and the stroke is electrically and hydraulically controlled so that assembly of the three members is accurately maintained and production is increased.

Do you have a production assembly or inspection problem where you can utilize to advantage a special purpose machine? Why not write us today describing your problem. After our engineering department analyzes it, our field engineer will discuss it with you.

TURNER BROS. INC.
2625 HILTON ROAD
FERNDALE 20, MICHIGAN

DESIGNERS and BUILDERS of:
- SPECIAL MACHINES
- JIGS and FIXTURES

DETREX DEGREASERS

BETTER CORROSION PROTECTION

NEW TEFLON SEAL IN SOLVENT PUMP

LOWER HEIGHT

SMOOTH INTERIOR SIDE-WALL

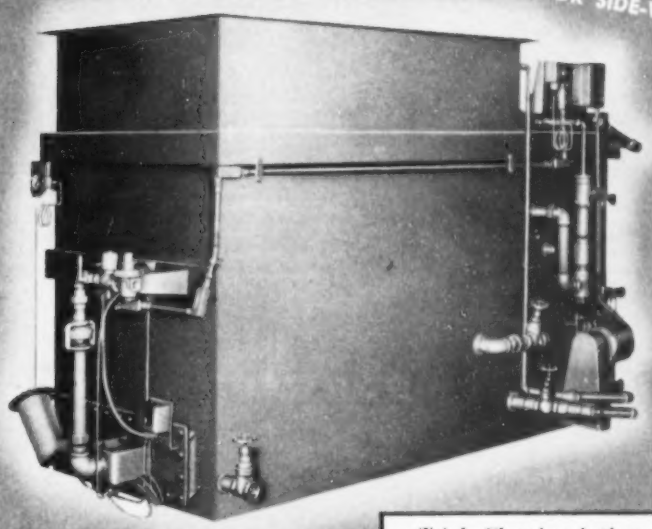
MOST EFFICIENT GAS BURNER

ENLARGED ACCESS DOORS

LESS FLOOR SPACE

OPERATED FROM EITHER SIDE

INTEGRAL STORAGE TANK COMPLETELY ACCESSIBLE



Triple Cleaning Action: *(1) initial pure vapor cleaning; (2) spray flushing with oil-free solvent distillate; (3) final pure vapor rinse.*

9 great new features ... in the VS 800 series

Industry's most popular type of hand-operated degreasers—the Detrex VS 800 Series—have been redesigned with 9 important advancements to afford still more economy of operation, greater utility and easier maintenance.

New atmospheric gas-fired immersion tube heating elements increase heating efficiency 50% (in some cases as much as 100%), save fuel, and permit thermostatic control of the heating tube. (VS 800 degreasers also are quickly adaptable for electric or steam heating.)

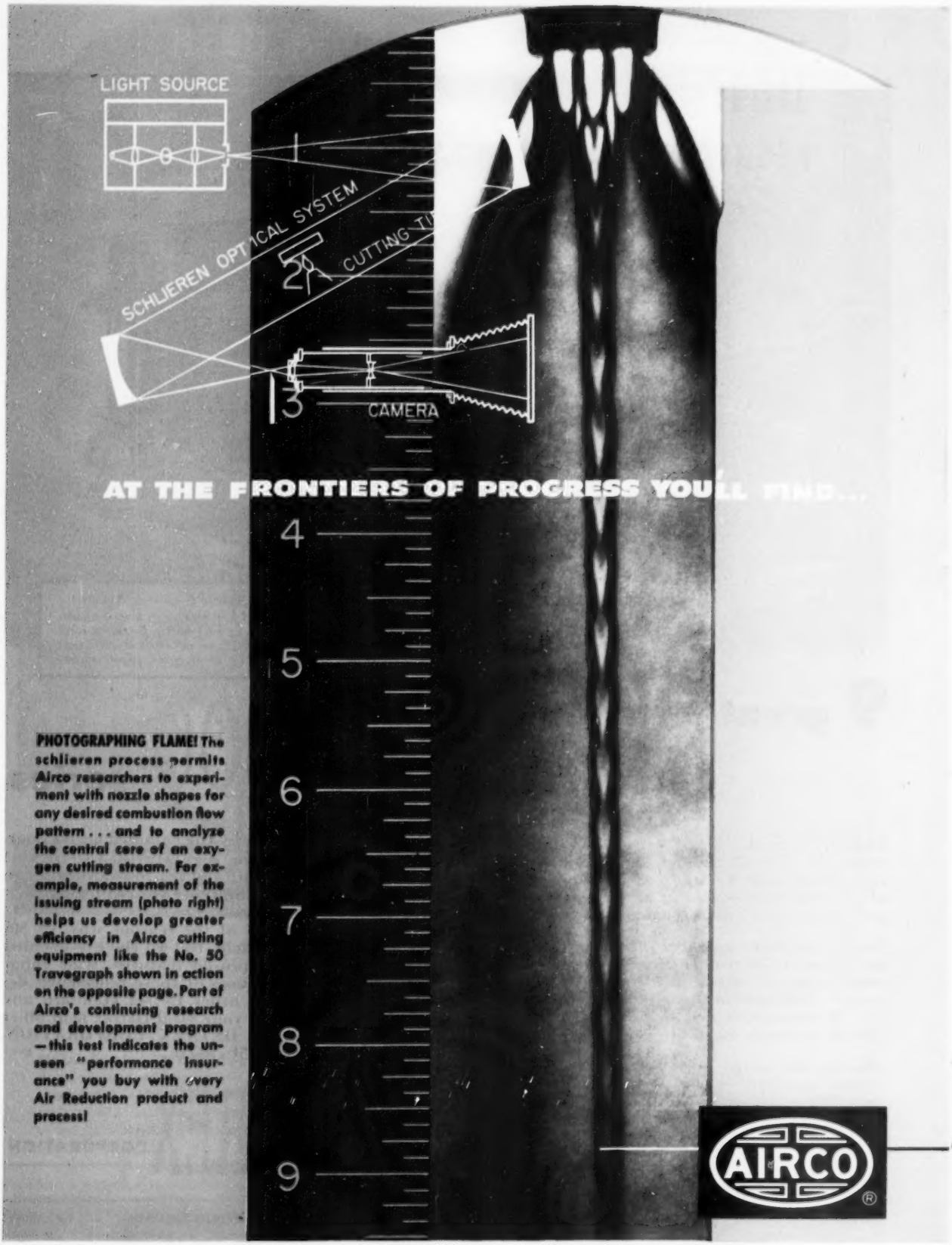
The interior of the degreaser, including the distillate reservoir, is coated with FF-1 . . . the new Detrex non-porous coating which is completely moisture-resistant and unaffected by degreasing solvents. It has shown no failures after severe and prolonged field use.

Redesign of the Detrex VS 800 has removed all interior projections, lowered working height, and provided flexibility of operation from either side. Compact construction has reduced floor space, the storage tank has been built into the unit to eliminate a separate container, and maintenance has been made easier by the enlarged access door. A new pump design uses corrosion-resistant materials throughout, and features a new teflon mechanical seal to eliminate solvent leaks.

These are but a few of the reasons why VS 800 degreasers lead the field. Get all the eye-opening facts about the improved features, wide range of sizes, and many uses of these redesigned degreasers, as well as other Detrex standard and special models. Call your local Detrex field office or write direct to DETREX CORPORATION, Box 501, Detroit 32, Michigan. D-1

DETREX CORPORATION

DEGREASERS • DEGREASING SOLVENTS • WASHERS
ALKALI & EMULSION CLEANERS • DRYCLEANING EQUIPMENT
PHOSPHATE COATING PROCESSES



AT THE FRONTIERS OF PROGRESS YOU'LL FIND...

PHOTOGRAPHING FLAME! The schlieren process permits Airco researchers to experiment with nozzle shapes for any desired combustion flow pattern . . . and to analyze the central core of an oxygen cutting stream. For example, measurement of the issuing stream (photo right) helps us develop greater efficiency in Airco cutting equipment like the No. 50 Travegraph shown in action on the opposite page. Part of Airco's continuing research and development program—this test indicates the unseen "performance insurance" you buy with every Air Reduction product and process!

AIRCO®

OXYGEN • ACETYLENE • NITROGEN • ARGON • HELIUM • OTHER INDUSTRIAL & RARE GASES • OXYACETYLENE WELDING &

"custom-cutting"

in a steel warehouse

THIS AIRCO NO. 50 TRAVOGRAPH multi-torch cutting machine has boosted warehouse steel orders by supplying an entirely new type of service.

Here's how it works: customers supply an outline drawing or paper cutout of the required part. An "electronic eye" traces the guide with hairline accuracy. Irregular shapes, inside and outside square corners, obtuse angles, slim slots and intricate contours—the Airco No. 50 Travograph takes them all in stride. Circles up to 12 feet in diameter—thicknesses up to 6 inches! By keeping all 8 torches in operation, this warehouse company mass produces intricate shapes so accurately that further machining is, in most cases, unnecessary. Contact your nearest Airco office for complete details.

And remember, when you need oxygen, acetylene, nitrogen, other industrial or rare gases, think of Air Reduction. A nation-wide distribution system will supply your needs.

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DEALERS AND OFFICES IN MANY PRINCIPAL CITIES

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CUTTING APPARATUS • CALCIUM CARBIDE • ARC WELDING & INERT-GAS WELDING EQUIPMENT • WELDING SUPPLIES & ACCESSORIES

DIAL FOR ACCURATE

High Speed Inspection

Depth Gage. Readings to 1/1000th.

1" Range Dial Indicator. Adaptable to many tools. Readings to 1/10,000th.

When your production must be held to close tolerances there's a Tumico Dial Indicator gage that will make high speed, accurate inspections. High visibility dials give instant and accurate readings. Our complete and diversified line may provide exactly the right type of dial indicator gage to best speed and insure accurate inspections.

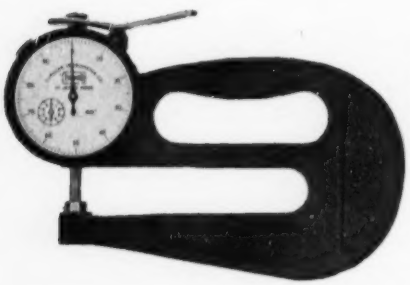
Let our engineers examine your product inspection problem. Write for new catalog showing additional models.

DIAL FOR ACCURATE

High Frequency Checking

1" Range Dial Indicator. Attaches to many tools. Readings to 1/1000th.

Lever Action Hand Thickness Gage with 1" Throat Depth. Readings to 1/1000th.



Lever Action Hand Thickness Gage with 4" Throat Depth. Readings to 1/1000th.

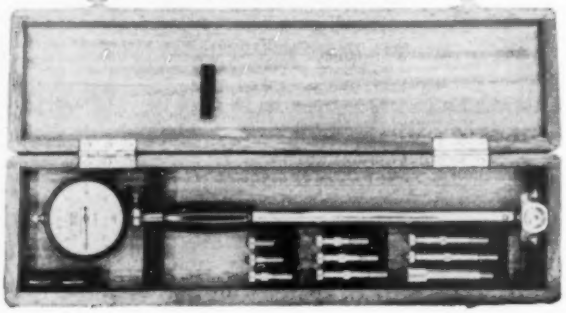
"Quality Control" of production lines can often be improved and speeded up by frequent spot checking with Tumico Dial Indicator hand and bench gages. High visibility assures quick, accurate readings to check vital production points.

Our production engineering department may be able to help you. Write us your problem. Our recommendations and complete catalog showing gages not illustrated will be sent promptly.

TUMICO DIAL INDICATORS

TUBULAR MICROMETER CO., Box 20, St. James, Minnesota

Dial Bore Depth Gage. Range from 2" to 6" in 10" Bore Depth in 5/10,000ths.



Pressure Processing

. . . whoever uses it in their production is a customer or potential customer of **H-P-M**

600 DRAWS AN HOUR!

The cup of the Revere whistling teakettle is drawn at the rate of 600 per hour on a standard H-P-M 150-ton Pot and Pan press.

Cupping, clipping, beading, tapering and other forming operations at the Rome Manufacturing Company, division of Revere Copper and Brass, Inc. are all handled on dependable H-P-M All-Hydraulic Fastraverse Presses at phenomenal speeds.

If you have a pressure processing application, it will pay you well to talk shop with an H-P-M engineer. Write today.

HPM

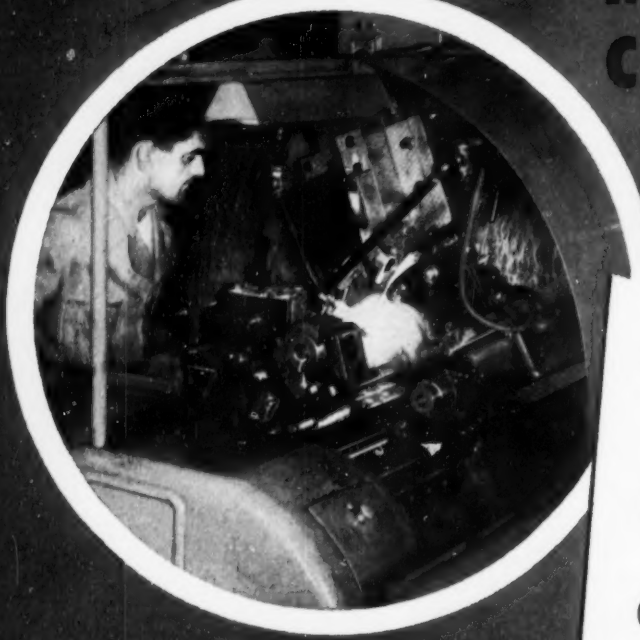
THE HYDRAULIC PRESS MFG. CO.

1002 Marion Road, Mount Gilead, Ohio, U. S. A.

Presses for Every Pressure Processing Application

WHAT'S YOUR GUESS ON THIS

Machinability Comparison?



ENDURO STAINLESS STEEL BARS ARE —% AS MACHINABLE AS BESSEMER SCREW STOCK

Would You Say

(a) *42%* (b) *67%* (c) *100%*
(d) *33%* (e) *90%*

?

YOU CAN APPLY the high physical and chemical properties of ENDURO Stainless Steel to duplicate parts you're running now —and still get fast automatic production.

Free-Machining ENDURO Bars are cold-finished by Republic's Union Drawn Steel Division especially for that purpose. They provide close tolerances, accuracy of section, uniform soundness, and fine surface finish.

Two grades are fully 90% as machinable as Bessemer screw stock. If 90% was your answer to the question above, you've probably had experience with Free-Machining ENDURO Bars. If you haven't, Republic metallurgists will be glad to give you prompt assistance on applications, processing, and use. Free-Machining ENDURO also is available in hot-rolled bars and in wire. Get more details from your nearest Republic District Sales Office, or write:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic ENDURO®
FREE-MACHINING
STAINLESS STEEL

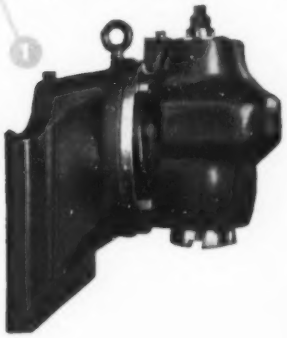
REPUBLIC STEEL

Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

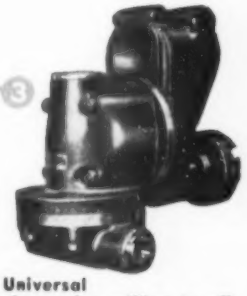
Milling Machine Attachments that STEP UP PRODUCTION

You can easily convert your general duty Milling Machine to a special purpose Miller by utilizing Kempsmith Standard Attachments. They can handle a great variety of milling operations with speed and precision, thereby enabling you to step up your plant production. Attachments 1 to 3, shown below, can be mounted on Kempsmith Millers. Numbers 4 to 7, inclusive, can be mounted on ANY make of milling machine. The same high degree of rigidity and precision characteristic of Kempsmith Milling Machines for more than 60 years is embodied in these sturdy standard attachments. Thousands are serving industry every day, performing the most delicate and accurate operations, or handling difficult production milling jobs. So plan now on broadening the scope of YOUR milling machines by applying Kempsmith Attachments. Write for bulletins.

Vertical Head
Converts horizontal to vertical machine, retaining identical spindle characteristics. (Bulletin No. 105)



Slotter
Keyseating, broaching, general slotting, tool and die making, etc. (Bulletin No. 107)

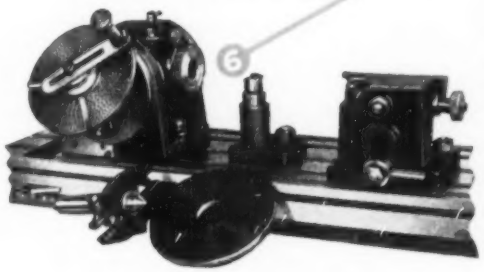


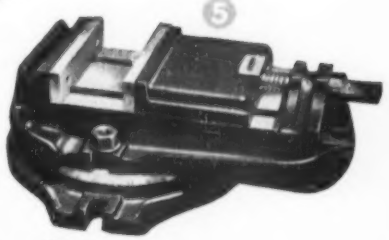
Hi-Speed Universal
High speed angular milling in all planes. (Bulletin No. 113)

Arbors and Accessories
A full range for standardized spindles carried in stock. (Bulletin No. 116)

Circular Table
Milling circles or cams, gear cutting, high-speed continuous milling, etc. (Bulletin No. 106)

Dividing Head
Precision indexing. Spiral cutting mechanism and chuck also available. (Bulletin No. 119)





Vises
Standard and Heavy-Duty, plain and swivel types. Adaptable to special jaws to save fixtures. (Bulletin 117)

THE KEMPSMITH MACHINE CO., MILWAUKEE 14, WISCONSIN, U. S. A.

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Precision Built Machine Tools Since 1888

The KEMPSMITH MACHINE CO.
Milwaukee 14, Wis., U.S.A.

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COPPER NAILS and TACKS

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BRASS and BRONZE BOLTS and NUTS

BRASS and BRONZE CAP, MACHINE and LAG SCREWS

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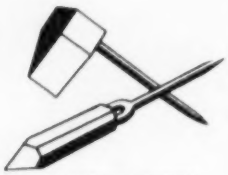
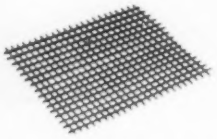


SOLDERING COPPERS



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PERFORATED METAL IN BRASS, BRONZE and COPPER

BEARING BRONZE BARS

CALL US FOR ANYTHING from Bearing Bronze Bars to Brass or Bronze Bolts . . . or any other brass or copper item for maintenance, repair, operating or production.

Twenty-three Chase warehouses are located in major industrial centers from coast to coast. Phone the one nearest you. We can usually fill your orders from stock.

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The Nation's Headquarters for Brass & Copper

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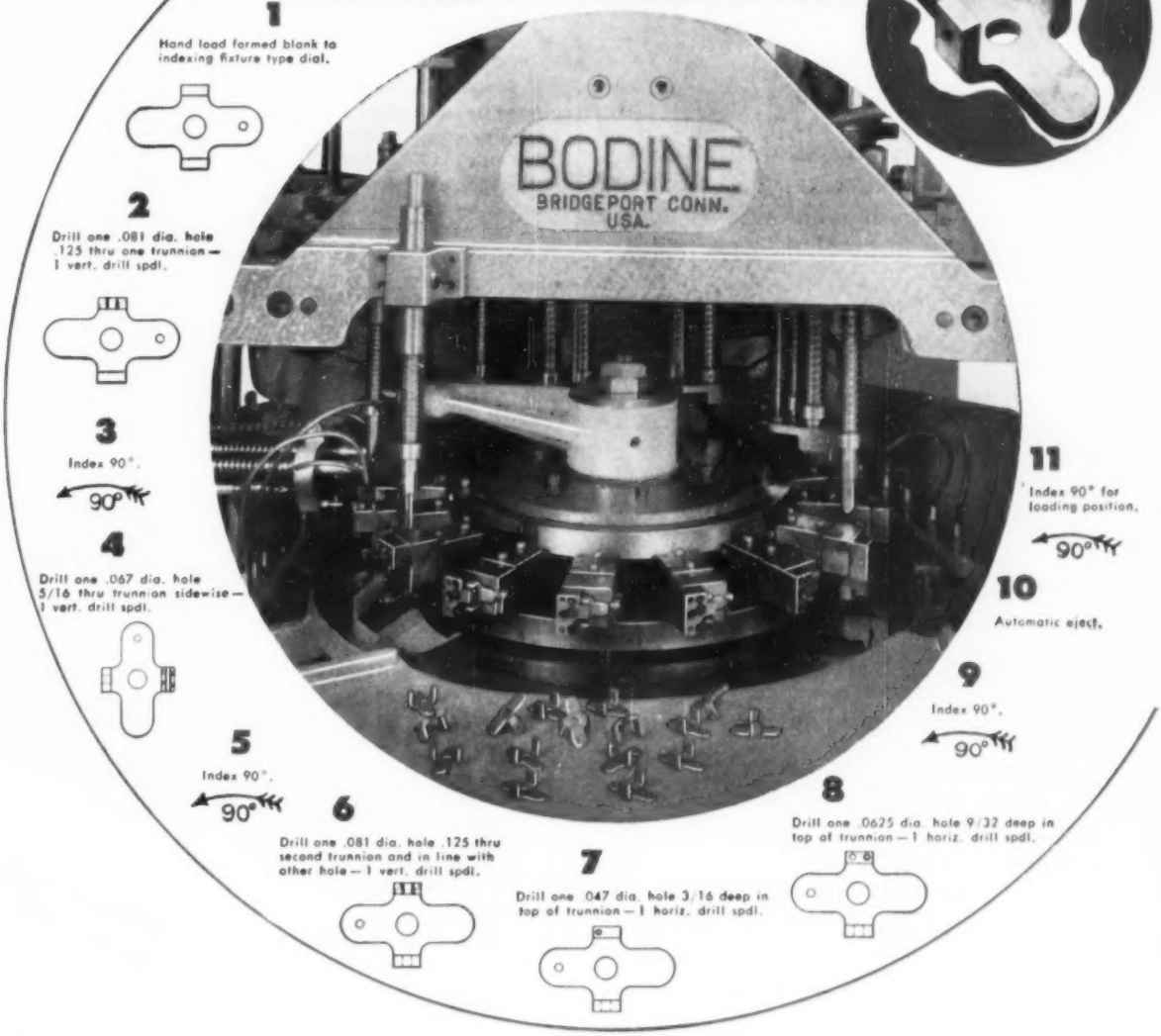
Atlanta	Cincinnati	Detroit	Los Angeles	New Orleans	Providence	Seattle
Baltimore	Cleveland	Houston†	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales office only)

Bodine CASE HISTORY NO. 34

PRODUCING A TELEPHONE ARMATURE OF MAGNETIC IRON


1
Hand load formed blank to indexing fixture type dial.
2
Drill one .081 dia. hole .125 thru one trunnion — 1 vert. drill spdl.
3
Index 90°.
90°
4
Drill one .067 dia. hole 5/16 thru trunnion sidewise — 1 vert. drill spdl.
5
Index 90°.
90°
6
Drill one .081 dia. hole .125 thru second trunnion and in line with other hole — 1 vert. drill spdl.
7
Drill one .047 dia. hole 3/16 deep in top of trunnion — 1 horiz. drill spdl.
8
Drill one .0625 dia. hole 9/32 deep in top of trunnion — 1 horiz. drill spdl.
9
Index 90°.
90°
10
Automatic eject.
11
Index 90° for loading position.
90°
BODINE
BRIDGEPORT CONN. USA.

PRODUCTION: The Bodine 42-30 automatic horizontal dial type of machine (one of 6 standard sizes) is equipped with 5 drill spindles (3 vertical, 2 horizontal) and special fixtures which automatically index the work 90° four times during the cycle. Production: 500 pieces (2500 operations) per 50-minute hour at 10 strokes per minute.

ACCURACY: *Alignment of two .081 dia holes ±.002; other hole locations to within 010, hole diameters held to ±.002.*

WRITE FOR INFORMATION *on high-speed repetitive production with combinations of drilling, tapping, milling, screw inserting, staking, and assembly.*

(BD53)

"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

SWANSON

V-LINER (PATENTED) INSPECTION UNIT

A new, universal inspection device which integrates all of the normal requirements of the Inspection Department

Saves space, man-hours, tool investment.

BASIC UNIT INCLUDES: (1) a 60° surface plate; (2) an exclusive, concentricity checking attachment; (3) adjustable bench centers; (4) V-blocks; (5) sine plate; (6) indicator attachment. All are self-aligning and quickly adjustable or removable. Specifications and tolerances meet finest precision standards. Savings in space, man-hours and tool investment are substantial.

Write for Bulletin V-1

The V-Liner Inspection Unit incorporates, all of the skill, precision and experience gained by Swanson in more than a third of a century of designing and building special automatic machines. Swanson machines have reduced costs, increased output and improved precision in hundreds of manufacturing operations.

. . . other
PRECISION PRODUCTS by SWANSON

V-Liner Concentricity Checking Fixtures
V-Liner Holding Fixtures
Turret Index Units
Memory Devices for Automatic Machines
Feeding Hoppers and Positioning Devices
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Engineers and builders of special, precision machinery

SWANSON
TOOL & MACHINE PRODUCTS INC., ERIE, PA.
Quality since 1919

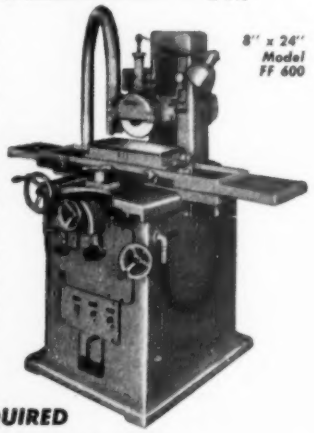
ABA PRECISION SURFACE GRINDER

OVER 1500 NOW IN USE!

WITH HYDRAULIC TABLE FEED AND ADDITIONAL HAND FEED

PARTIAL SPECIFICATIONS		
	Max. length of grinding area	24"
	Max. width of grinding area	8"
	Long. table speed, infinitely variable FPM	55'
	Grinding wheel	8"x¾"

Where highest precision is required the ABA precision Surface Grinder meets every test. With the aid of divided heads, sine plates, and other attachments it can handle the heaviest and most difficult jobs. Complete hydraulic table feed as well as manual operation make this grinder doubly practical. The use of ball bearings means extremely easy handling of all hand wheels and operating levers.



8" x 24" Model FF 600

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Willey's—The COMPLETE LINE of cutting tools—made complete in our own factories. Hundreds of standard sizes always in stock.

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Excellent service on special tools built to your specifications.

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Whether yours is the ***rush*** order for 25 ft. or 25,000 feet—the search for an ***odd*** type of tubing—or just a routine order, Tube Distributors' warehouse is geared to fulfill your needs not only intelligently, but "beyond-the-call-of-duty". This conviction of unremitting service to our customers has made us one of America's leading suppliers of tubes and tubing. Next time, call TD.

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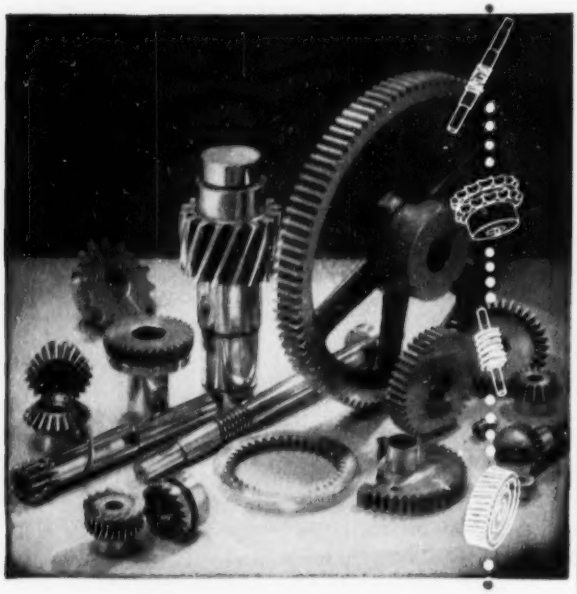
When you need the right gear *in a hurry*



It's one thing to get a gear cut exactly to your specifications . . . and another to get it *on time*. To be sure of satisfaction *both* ways, there's only one safe thing to do: specify Grant gears. For, whether you order by 'phone, telegraph or letter, Grant will have just the gear you want on its way in a matter of hours.

Next time a gear breakdown threatens a costly production tie-up, remember Grant's "in-the-pinch" service.

75th ANNIVERSARY

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Put your tooling and production problems into the capable hands of

"DOUGLAS PRODUCTIONEERS"

"Douglas Productioneers" are skilled craftsmen—available at all times to go anywhere in the world and set up an efficient tooling and production program. They are capable of building or re-working all types of jigs, dies, fixtures, special gages and tools from your tool drawings or prints and are experts on optical tooling. "Douglas Productioneers" will, if necessary, train your men to build or operate both special and standard equipment.

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PRODUCTIONEERS FOR INDUSTRY

DOUGLAS ENGINEERING CO.
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Hire these Speedy Production Triplets

better built by Black & Decker!

DRILL IT FASTER with a Black & Decker ¼" HOLGUN*

Heavy-Duty, 25% more powerful—can't be stalled at rated capacity! Only 7¼" long, ¾" spindle offset; weighs only 3¼ lbs. Unmatched for close quarter drilling in wood, metal and plastics!

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Threads holes in steel, cast iron, brass, aluminum, 8 times faster than by hand. Only 10¾" long; weighs only 4¼ lbs. Automatic reversing mechanism greatly reduces tap breakage!

DRIVE IT FASTER with a Black & Decker No. 12 SCRUGUN*

Now 30% more powerful for increased capacity! Only 9" overall; weighs only 3¼ lbs. Positive and adjustable clutch, 90° Angle Head models.

More output, fewer rejects, less fatigue!

THESE fast-stepping Black & Decker production triplets have a lot in common . . . and it's all good medicine for your production schedule! They're all powered by B&D-built universal motors, tailor-made for the specific tools they drive. They're all perfectly balanced and matched in design, with the famous "Pistol Grip and Trigger Switch" to give you easier handling, less worker fatigue. They're all engineered to turn out more uniform work at lower cost with fewer rejects. And they're all packed with the strength and stamina that Black & Decker builds into every part, every tool!

Find out how these production triplets can save you money, muscle and man-hours. See your nearby Black & Decker Distributor for a demonstration. Write for free catalog of over 100 Electric Tools to: THE BLACK & DECKER MFG. CO., 604 Pennsylvania Ave., Towson 4, Maryland.

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Hamilton Works of Baldwin-Lima-Hamilton is first in the book in the 1953 edition of SWEET'S Machine Tool Catalogs.

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BALDWIN

A 32 PAGE FUND OF VALUABLE INFORMATION COVERING PERFORMANCE AND CAPACITIES OF:

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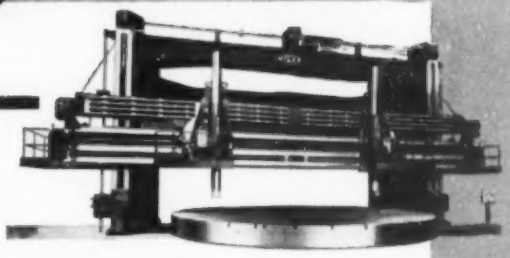
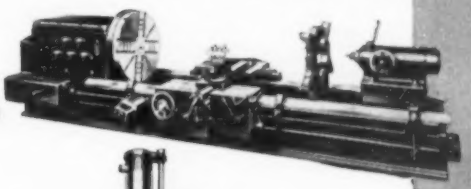
boring mills



NILES
engine lathes



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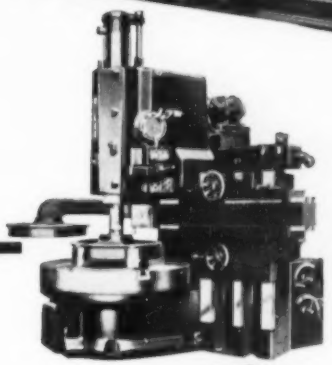
railroad tools



HAMILTON
mechanical presses

-LIMA-HAMILTON

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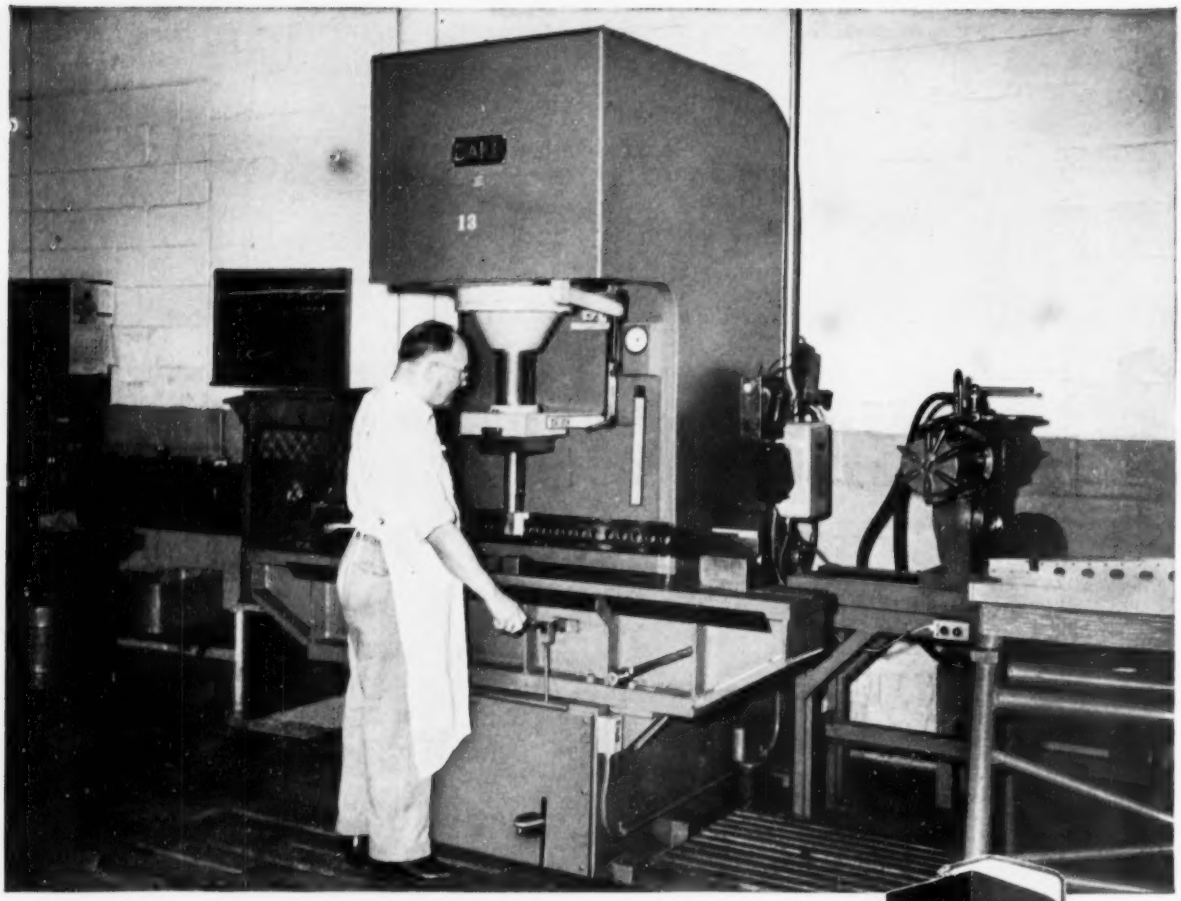


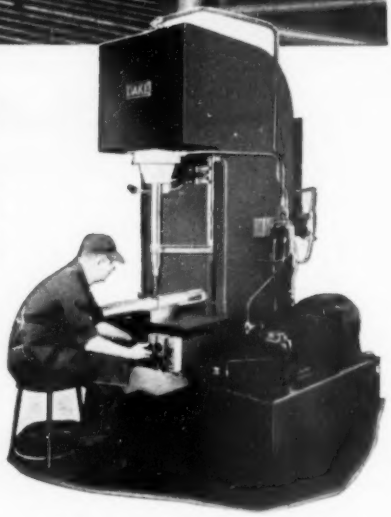
How to Straighten Flap Tracks

Precision parts for aircraft call for the use of precision equipment.

These flap tracks, machined from 4130 steel (aircraft quality), must be checked on a straightening press four times during fabrication. For ease of control and accuracy, the work is done on Dake Gap Type Presses like that shown above.

To the right of the ram, the operator has piaced a rule gauge which indicates ram travel. Knowing the elasticity of the piece being tested, he can estimate the overtravel necessary to straighten the piece with a single movement of the ram.

Dake Gap Type Presses are available for straightening or forcing, in 22 models ranging up to 300 tons capacity. They are fully described in Bulletin No. 299 —sent on request.



This Dake Gap Type Press is used for broaching boring bars

Dake Engine Company, 636 Seventh St., Grand Haven, Mich.

DAKE PRESSES

Arbor Presses

Hand Operated Hydraulic

Power Operated Hydraulic

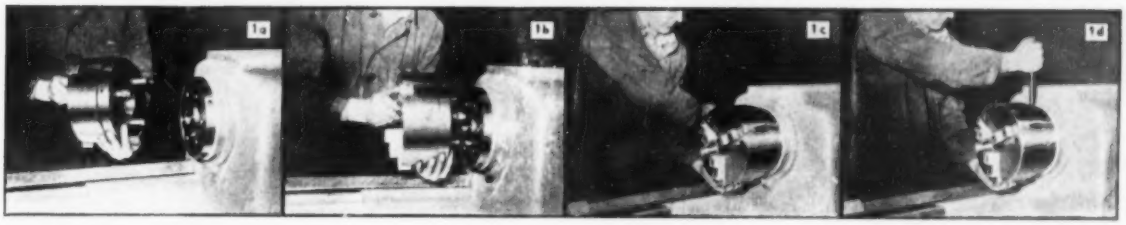
Guided Platen

Gap Type Presses

Movable Frame

6 Advantages of the GOLIATH-
High Speed Lathe

- which have brought it so quickly into high demand



1 a - d **Quick chucking device** (German Patent)
Short-tapered spindle nose acc. to DIN 812 allows change of face plate, chuck, dog plate etc. in far less time than is required in the case of any other lathe. It will take you no longer than you need to read these lines . . . 6 to 10 seconds at most.

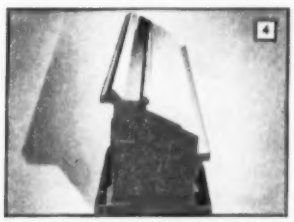
2 **Control of 12 spindle speeds trough only two levers**
You need but operate a single cross handle and the back gear lever, to control 12 spindle speeds, row I: 24 - 1000 r.p.m., or row II: 32 - 1400 r.p.m.

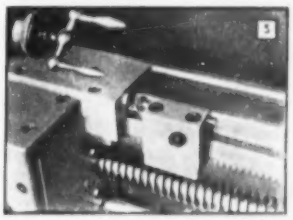
3 **Control of all threads and feeds through a single control block**
No tumbler yoke. All gears hardened and ground and with oil bath lubrication. Coarse thread 1:8. Multiple thread cutting device.

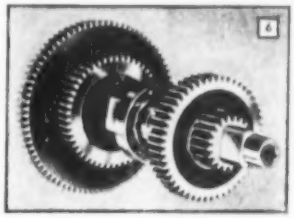
4 **Inverted V-way bed**
Novel bed construction. Chip-slide to the rear. Bed reinforced through diagonal ribs. Full-length box type support. Protected V-ways.

5 **Automatic apron release**
Release accuracy of .0004" guaranteed by patented drop-worm device. No recoiling of carriage.

6 **All sliding wheels and shafts with (K) Profile**
For more than 10 years we have been using the patented triangle (K) profile instead of hexagon spline shafts. This offers additional safety, as displacing of wheels is impossible while machine is running, and extends lifetime of lathe.





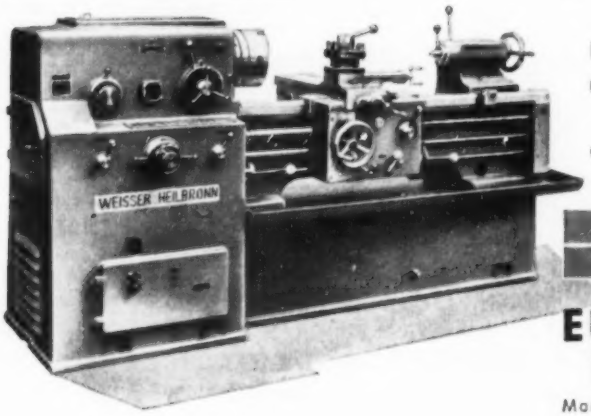


Specifications

Max. swing over bed	18½" or 19¾"
Max. swing over cross slide	8¼" or 9⅞"
Distance between centers	30" / 40" / 60"
Motor	7,5 or 10 H.P.

Advice and service through our authorized expert agents.
Write for English prospectus No. 2132 to be sent to you without obligation.

Always Best! Always Weisser!



Representatives and Service:

USA: Guthery Machine Tool Corp., 130 West 42nd Street, New York 36, N. Y. Telephone: CHickering 4-2820.

Canada: Transocean Machine Company Inc., 1170 Drummond Street, Montreal P.Q. Telephone: UNiversity 6-3304.

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EUGEN WEISSER & CO. KG.
HEILBRONN / NECKAR (Germany)
Machine Tool Manufacturer – Salzstrasse 79/83 and 128/130

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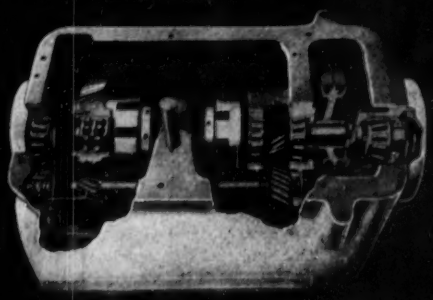
Production Specialists

Acme's complete facilities include over one hundred major machine tools.



Our 25 years' continuous gear production for aircraft and industrial needs will prove valuable to you.

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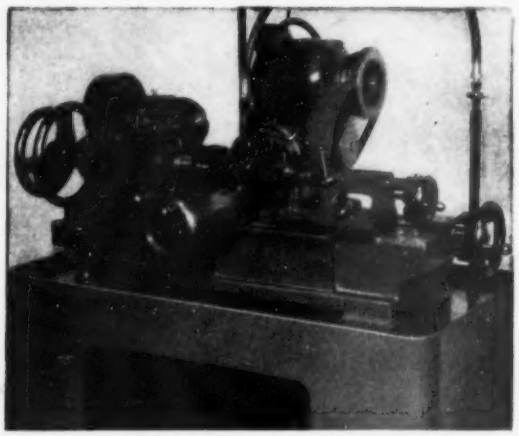


WALTHAM THREAD MILLING MACHINES

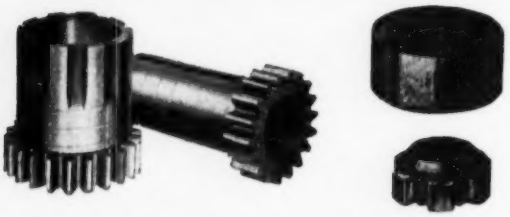
. . . for producing accurate, fine-finish threads on small diameters at low cost

This NEW model is mounted on a welded steel base in which are accessibly located control panel, coolant motor and pump. It is equipped with separate motors for cutter, work and coolant. Motor push buttons are conveniently placed.

Swing over carriage is 3" and work 2" diameter or smaller can be handled. Threads 8¾" long can be cut with work held on centers. Special attachments are available for extending the utility of this machine. *Illustrated literature available on request.*

• WALTHAM MACHINE WORKS
HIGH STREET WALTHAM, MASS.

MADE WITH PRECISION— SOLD WITH CONFIDENCE



Each gear order we receive, no matter what the specifications or quantity, gets our very closest attention. Each step of gear manufacture is carefully controlled to assure lasting service and satisfaction. THE ADAMS COMPANY, 1905 Bridge Street, Dubuque, Iowa

the ADAMS line . . .

SPUR GEARS	INTERNAL GEARS	SHAVED TOOTH
BEVEL AND	(Spur and Helical)	GEARS
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WORMS AND	SPLINED SHAFTS	GROUND THREAD
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The ADAMS Compa
Dubuque, Iowa, U.S.A.
ESTABLISHED 1883

GEARS

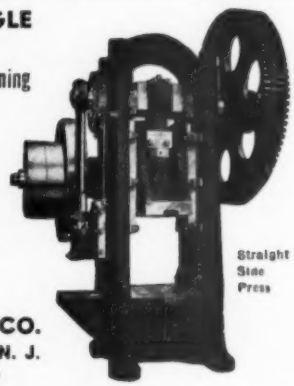
FINE GEARS MADE TO YOUR SPECIFICATIONS

STRAIGHT SIDE SINGLE CRANK PRESSES
for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

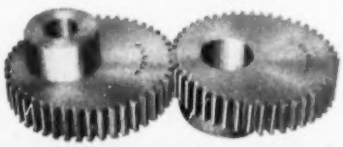
Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

Full details on request.



Straight Side Press

ZEH & HAHNEMANN CO.
NEWARK N. J.
180 Vanderpool Street



ELLIPTICAL GEARS
Also Other Non-Circular Gears

BILGRAM TRADE MARK

ALL TYPES OF GEARS

BILGRAM GEAR & MACHINE WORKS
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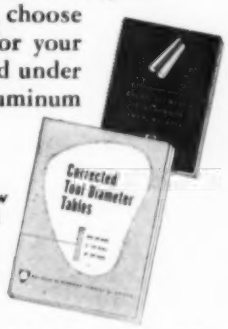
Let ALCOA help with alloy selection on your aluminum jobs

Aluminum is many metals. If your parts require high strength there are Alcoa alloys stronger than steel. Need *extra* corrosion resistance? Some alloys resist most atmospheres and hundreds of corrosive chemicals. Want exceptional machinability — high thermal and electrical conductivity — ability to take fine finishes? There are Alcoa alloys outstanding in each respect.

Your local Alcoa sales engineer will help you choose the alloy that combines the best properties for your civilian and defense jobs. You'll find him listed under "Aluminum" in the classified phone book. Aluminum Company of America, 871-C Alcoa Building, Pittsburgh 19, Pennsylvania.



TWO FREE BOOKS — *Alcoa Aluminum in Automatic Screw Machines* — a 99-page book containing information on tool design, setup and operating techniques.

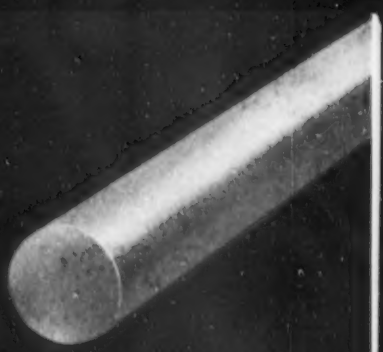
Corrected Tool Diameter Tables — a 64-page book giving corrected tool diameters for circular form tools and flat form tools under conditions of 0°, 5° and 10° top rake.

BASIC ECONOMICS FOR BUYERS

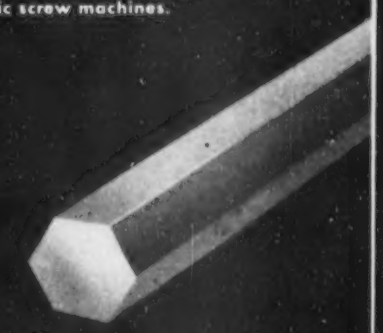
While you buy screw machine stock by the pound, you machine it by the foot. A pound of aluminum gives you three times more feet of stock than a pound of brass or steel.

Alcoa Aluminum

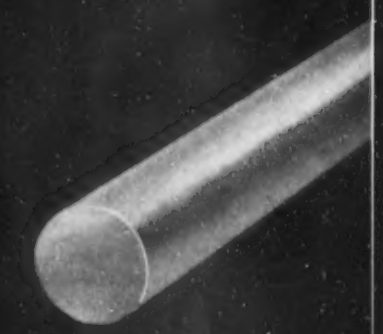
ALUMINUM COMPANY OF AMERICA



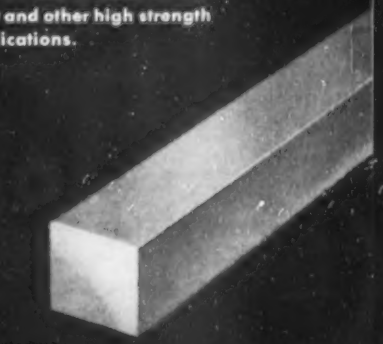
ALCOA 11S-T3
—the best general-purpose aluminum alloy for automatic screw machines.



ALCOA 17S-T4
—is stronger than 11S-T3, is better for deep hole drilling.

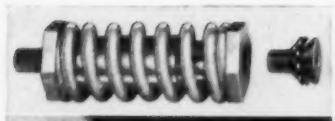


ALCOA 24S-T4
—is even stronger than 17S-T4 and is used for aircraft and other high strength applications.

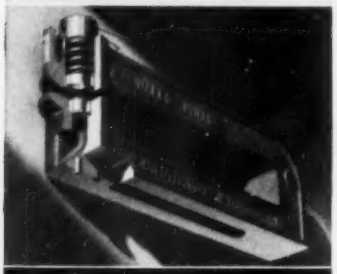


ALCOA 61S-T6
—has high corrosion resistance and is best for anodized finishes.

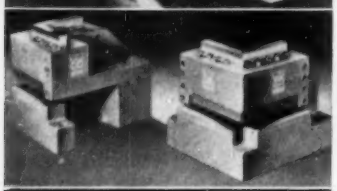
WHAT WALES LEADERSHIP THROUGH CONTINUING RESEARCH and DEVELOPMENT *means to you*



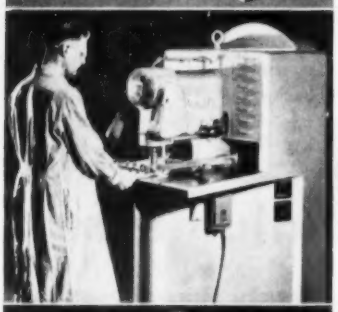
1928 WALES *Strippits* revolutionize die making by providing a spring held compressed by a retainer to standardize stripping pressures.



1932 WALES *Self-Contained Hole Punching Units* incorporate the basic Strippit principle to provide free-floating punch and guide for independent design.



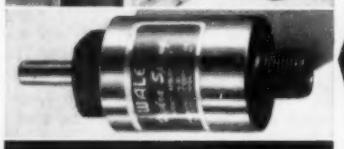
1936 WALES *Self-Contained Notching Units* are an outgrowth of the successful applications of Wales Hole Punching Units and Wales Strippits.



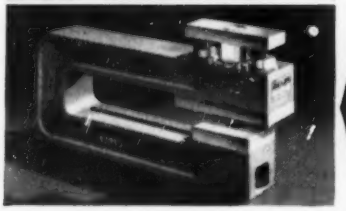
1943 WALES *Fabricators* provide rapid interchangeability for punching, notching and nibbling . . . no templates required. Work from prints or operation sheets.

1946 WALES *Drilling Machines* are designed to meet precision requirements of locating, drilling, boring and reaming holes . . . no other drilling machine or jig borer like it.

1951 WALES *Hydra Springs* utilize the compressibility of Wales Comproils to provide up to 600% more pressure than conventional springs.



1952 WALES *Hydra-Strip Hole Punching Units* with built-in Wales Hydra Springs permit these self-contained Units to punch and strip material up to 3/4" thick.



195–

● This chronological array of Wales patented equipment is only a partial list of the numerous exclusive products developed through years of research by Wales Engineers.

That is one of many reasons why thousands of manufacturers have made it a standard practice rule to standardize on Wales developments. You, too, will be years ahead in time-saving, money-saving production techniques by putting Wales Equipment to work in your plant.

To assist you, Wales Sales Engineers are strategically located throughout the country. These engineers are more than just "factory trained" . . . they have been employed by this Corporation for years before servicing prospects and customers.

For further information on how WALES products will modernize your operations, write for illustrated catalogs TODAY.

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(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada, Ltd., Hamilton, Ontario

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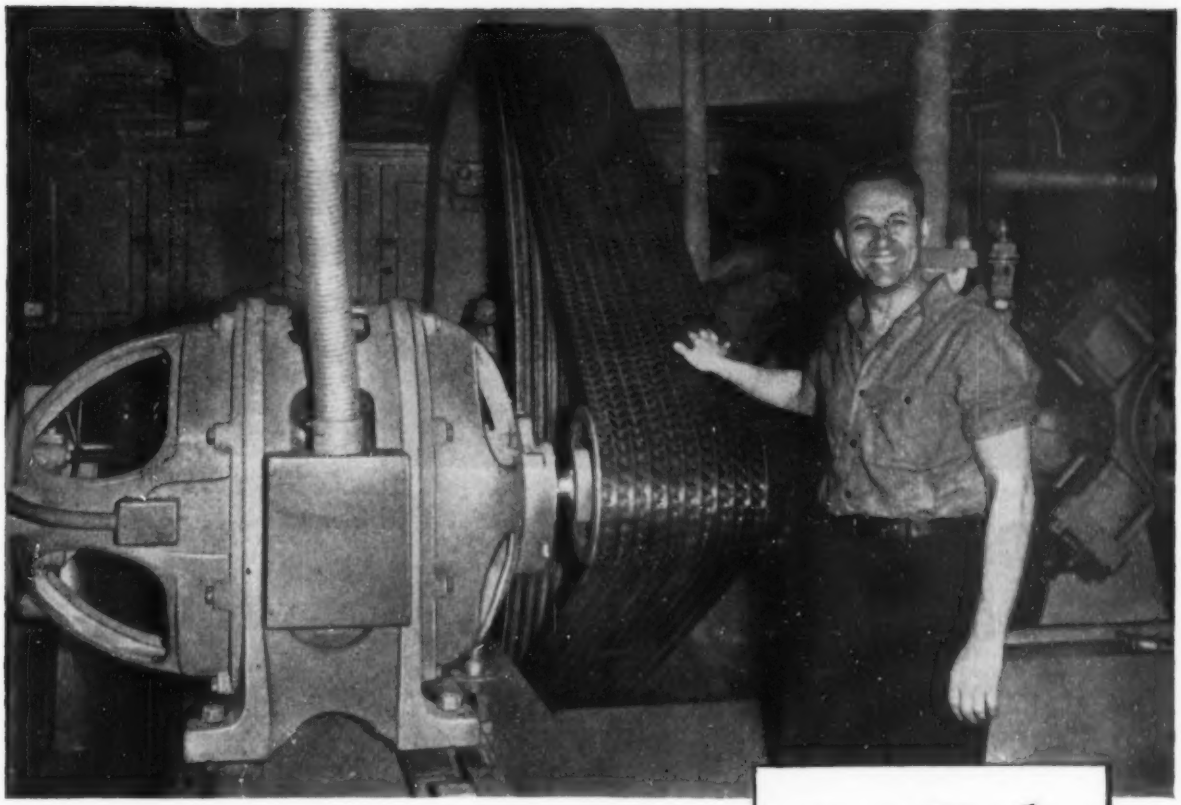

with Veelos on your machines...

v-belt replacement takes up to 90% less time

Actual in-plant records prove that Veelos v-belt can be installed *and operating* in up to 1/10th the time regularly needed to do the same job using endless v-belts.

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V-BELT

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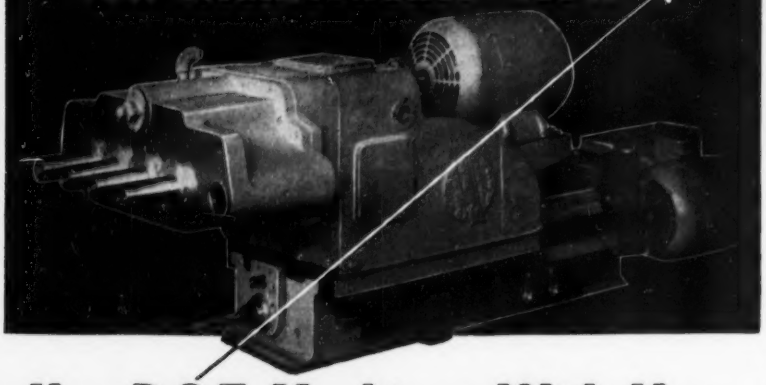
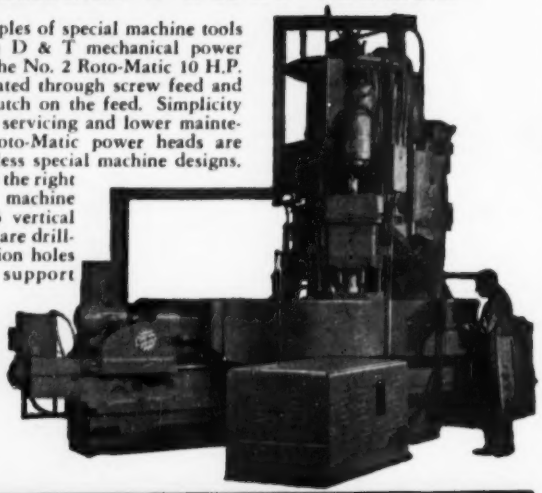
For High Production and Low Maintenance Costs *



Use D&T Machines With New Mechanical Power Heads

Here are two good examples of special machine tools designed and built with D & T mechanical power heads. Shown above, is the No. 2 Roto-Matic 10 H.P. head. All sizes are operated through screw feed and have overload release clutch on the feed. Simplicity of design makes for less servicing and lower maintenance costs. D & T Roto-Matic power heads are readily adapted to countless special machine designs. For instance: Machine to the right is a 6 station indexing machine with 3 horizontal and 3 vertical power heads. Operations are drilling and reaming suspension holes and king pin holes in support arms for power heads.



Free Data

is available on the complete line of D & T machines. Ask for Bulletin 1000.

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SPECIFICATIONS

Model	Size	Tool Capacity
P-60	0	1/8 to 5/16
P-61	1	3/16 to 3/8
P-62	2	1/4 to 1/2
P-64	4	5/16 to 5/8

Specify left or right hand offset

For complete information call your Clark Cutter Jobber now or write Factory A.

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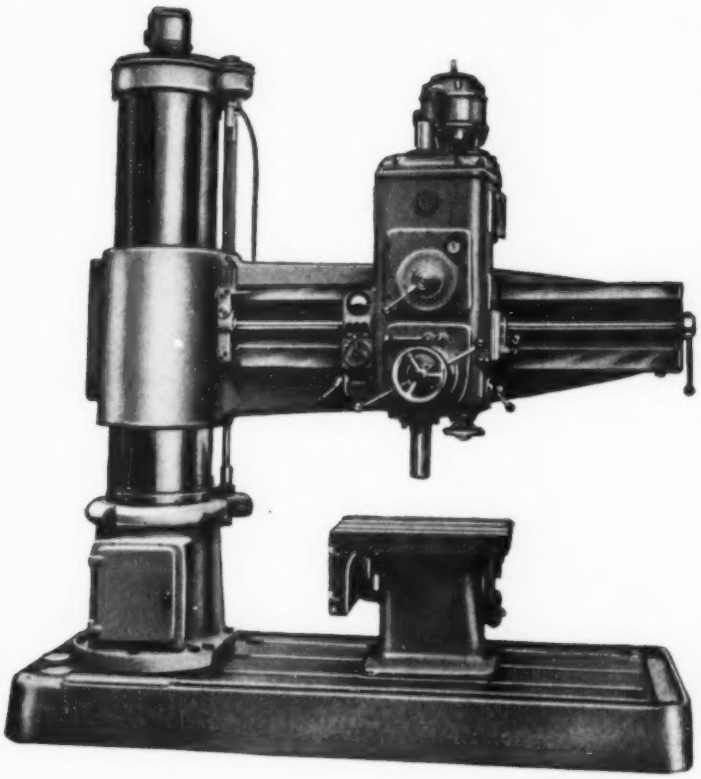
KOLB RADIAL DRILLS FOR LIGHT · MEDIUM · HEAVY DUTY



For greater efficiency, 36 speeds and 12 feeds can be pre-selected on this HKH Kolb Radial equipped with electro-hydraulic pre-selectors.

FOR ACCURATE PRODUCTION

- Heavy bases, columns and arms —Rigidly constructed
- Column diameters from 7½" to 35"
- Flanged motor mounted on top of spindle head
- Hardened and ground gears
- Hardened and ground spline shafts rotating on ball bearings

FOR SPEEDIER PRODUCTION

- Selector device for pre-setting speeds and feeds
- Rigid locking of column and spindle head by electro-hydraulic clamping system (automatically or by hand)
- Push button controls
- Automatic depth release

FOR YOUR PRODUCTION

- Maximum drilling capacities Cast Iron—8" dia. Steel—6" dia.
- Maximum drill radii—27" to 180"
- Spindle speeds—12, 24 or 36—from 30 to 3000 R.P.M.
- Feeds—6, 9, 12 or 18—from .0012" to .1181" per rev.

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LET COSA QUOTE ON YOUR SPECIFIC NEEDS

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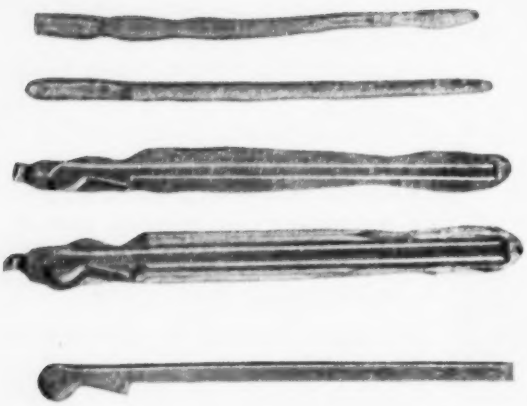
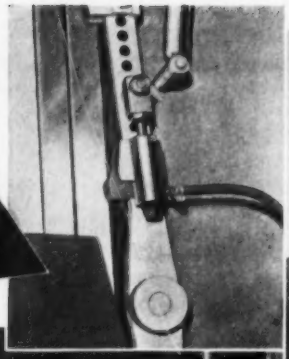
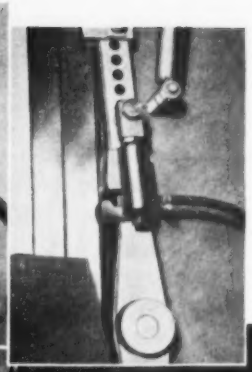
CECO-DROP SHORT STROKE CONTROL

"Makes the Hammer Talk!"

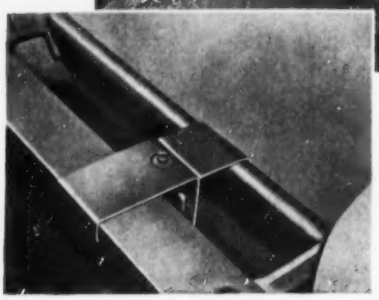






An installation of a Short Stroke Control on a 2500 lb. CHAMBERSBURG CECO-DROP HAMMER is shown, forging steel ankle joints for leg braces. Above are samples of the forging as it appears during various stages. The forging process begins with a series of 20 to 23 short, rapid blows (about 18" stroke) to draw the 2½" dia. stock. This is followed by two long blows (about 35" stroke) to roll it, three more long blows in the rough impression, and three more long blows to complete the forging. After the last blow the ram is stopped on the up-stroke at the "short blow" position for the next forging.

Short Stroke Control is but one of the many features of Chambersburg CECO-DROPS. These piston lift, gravity drop hammers are setting new standards in forge shop production. Lower operating costs, minimum down time, easy operation, wide range of operations, extra safety; all add up to "more forging per hour" the basis on which to judge the efficiency of a Drop Hammer. Write for Bulletin 11-L-0.



(Above right) Dog in full stroke Position. Wedge is lifted, Short Stroke Control is inoperative.

(Above left) Dog in Short Stroke Position. Wedge is down, holding dog in operating position.

(Lower left) Button on treadle when depressed by operator shortens the stroke. Release reverts to full stroke.

CHAMBERSBURG ENGINEERING COMPANY, CHAMBERSBURG, PA.

CHAMBERSBURG

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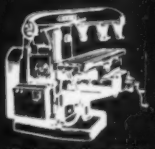
CVA Automatic Screw Machines

Jones & Shipman Hydraulic Surface Grinders



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DCMT Die Casting Machines

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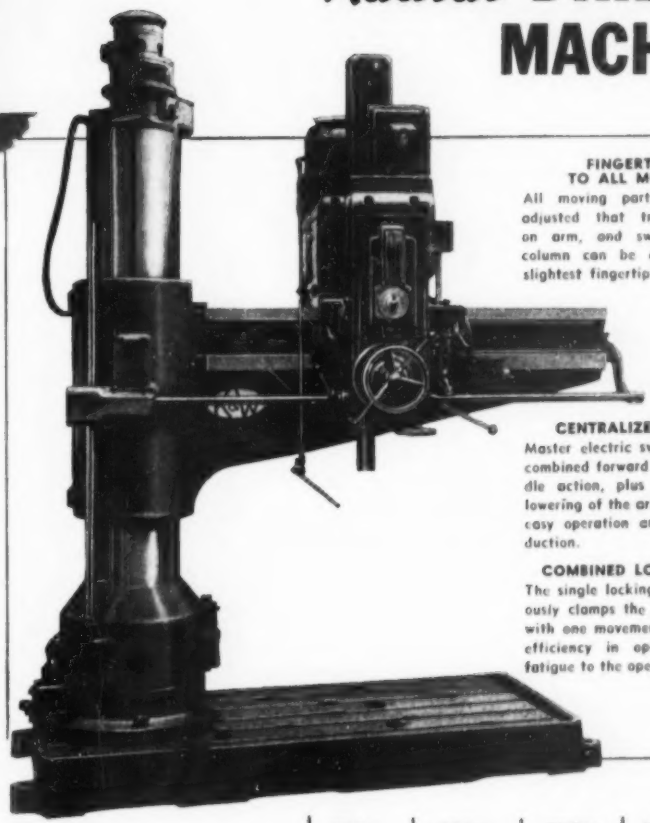
* LOWEST UNIT DRILLING COST

KITCHEN & WADE *Radial* DRILLING MACHINES



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All moving parts are so finely adjusted that traverse of head on arm, and swing of arm on column can be actuated by the slightest fingertip pressure.

CENTRALIZED CONTROL

Master electric switch controls the combined forward and reverse spindle action, plus the raising and lowering of the arm. This results in easy operation and increased production.

COMBINED LOCKING LEVER

The single locking lever simultaneously clamps the head and column with one movement, produces more efficiency in operation and less fatigue to the operator.

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Column . . . 17"
Radius . . . 6' to 8'

***In selecting a radial drilling machine,** it is essential to compare 3 basic production factors:

- Rate of drill penetration,
- Amount of Labor Cost in "setting-up" time,
- Amortization of capital investment against number of holes drilled.

Versatile **KITCHEN & WADE RADIAL DRILLS** compare favorably with the finest machines, in the first 2 factors.

Most important . . . it has been proven that their advanced features, sensitivity, **and low initial price, make them especially desirable, in producing quality work at exceptionally low cost per-hole-drilled.**

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Name and Model	Kitchen & Wade E25	Kitchen & Wade E26	Kitchen & Wade E24	Kitchen & Wade E27	Kitchen & Wade E28
Diameter of Column	10"	12"	14"	17"	20"
Radius of Drill Spindle	4'	5'	6'	8'	10'
Drills from Solid in Mild Steel	1½"	2"	3"	3"	3½"
Diameter of Spindle	1⅛"	1½"	2"	2½"	2½"
Traverse of Saddle Along Arm	34¾"	46¾"	55"	74"	96"
Morse Taper of Spindle	No. 4	No. 4	No. 5	No. 5	No. 5
Spindle Speeds — Number	8	8	12	36	36
Spindle Speeds — Range RPM	80-1500	80-1500	50-1250	8½-800	8½-800
Feeds — Number	4	4	4	9	9
Feeds — Range Inches per Rev.	.0045-.013	.006-.025	.007-.025	.007-.025	.007-.025
Horsepower of Main Motor	3	4	5	10	15
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WAUKESHA SPADE DRILLS with short length heads

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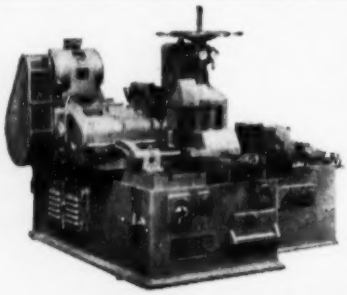

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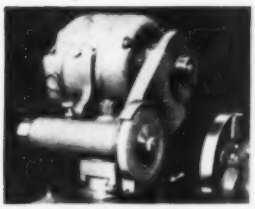
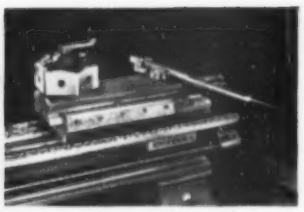


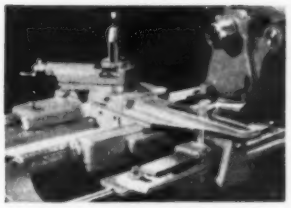
External Grinder

Milling Attachment

Handlever Tailstock



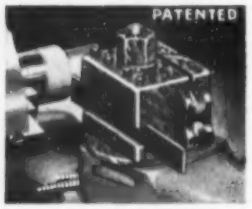
Handlever Bed Turret



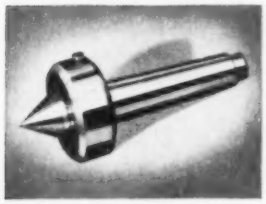
Telescopic Taper Attachment

Handwheel Collet Attachment

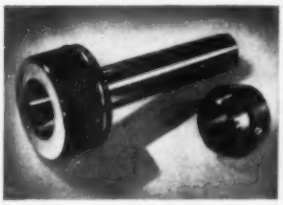
Handlever Collet Attachment



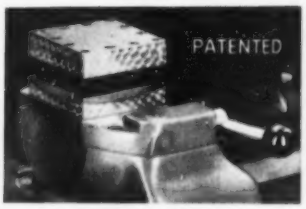
10 in 1 Tool Holder



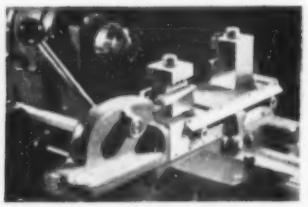
Ball Bearing Live Center



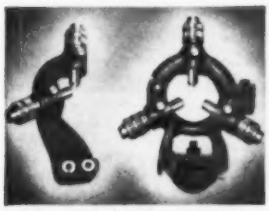
Adjustable Collet Bushing Chuck



Square Turret Tool Block



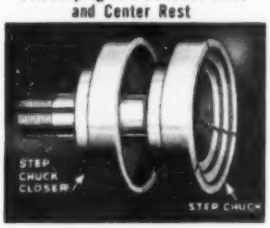
Handlever Double Tool Cross Slide



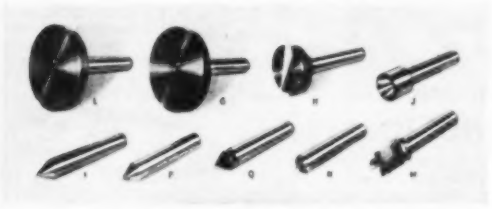
Telescoping Jaw Follower Rest and Center Rest

Collet Rack

Steel and Brass Collets

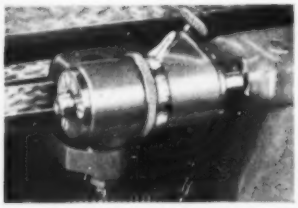


Step Chucks and Closers

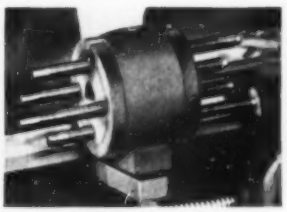


Centers and Drill Pads

Thread Dial Indicator



Micrometer Carriage Stop



Four Position Carriage Stop

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Lathe Attachments

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- Reduce Operator Fatigue

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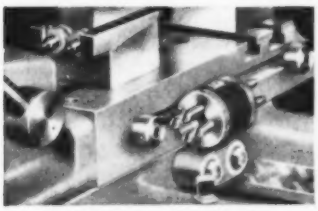
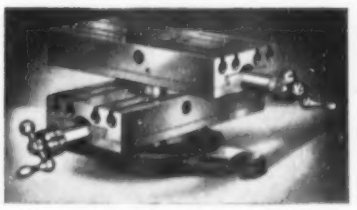


Four Position Cross Slide Stop

Safety and Standard Lathe Dogs

Coolant Pump



Universal Table

World's Most Versatile Metal Saw

MARVEL No. 8, Capacity 18" x 18"

There is no other sawing machine like it. The work remains stationary. The blade is guided with a 90° twist and power fed vertically through the work. The saw blade and column can be instantly swung and clamped at any angle to 45° either right or left from vertical for miter cutting.

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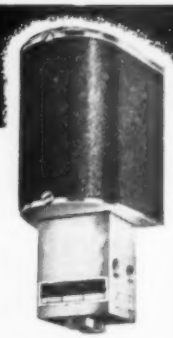

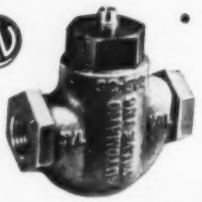

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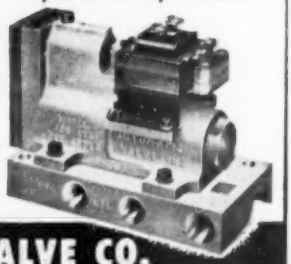

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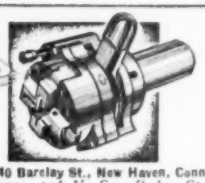

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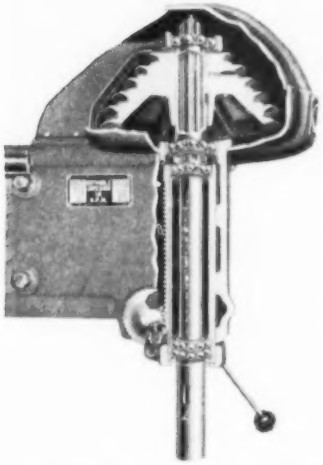
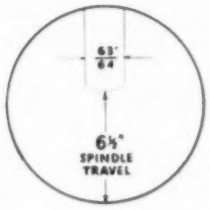
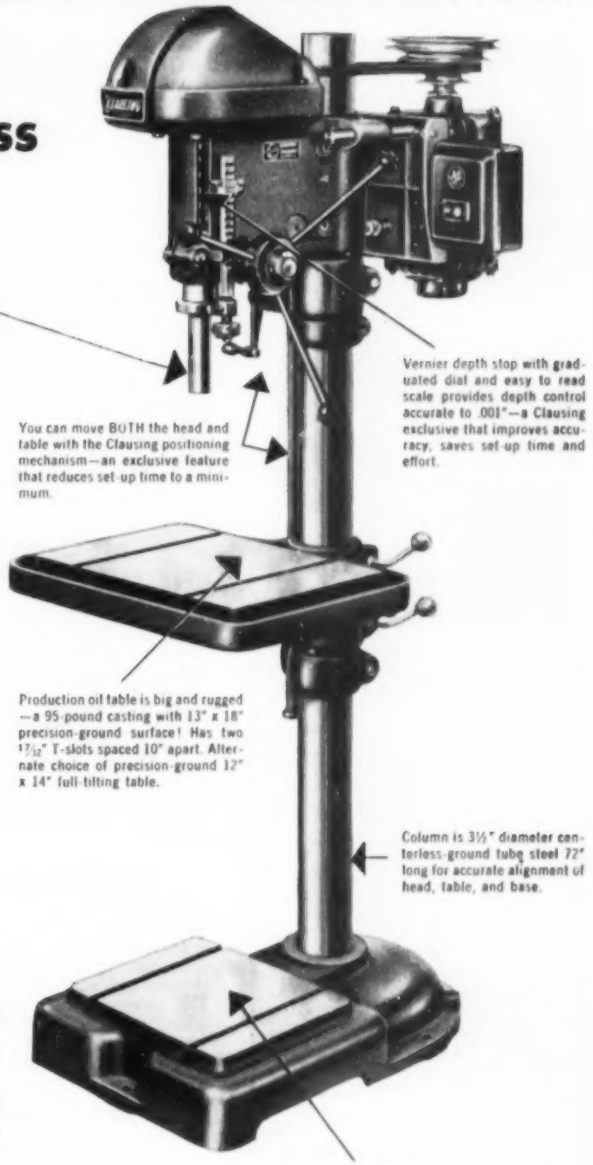


Construction of head, spindle, quill, and bearings of the Clausing 18" drill press assure precision work and lasting accuracy. Quill guides, drive bearing housing, and column bearings are line bored. Spindle is $6\frac{3}{64}$" precision-ground steel. Quill is also precision-ground steel, $2\frac{1}{8}$" in diameter with $\frac{5}{16}$" thick walls. Spindle turns on precision-type ball bearings spaced $8\frac{1}{2}$" apart. Upper bearing is sealed for life. Note the special double-row, double-shielded lower bearing—BOTH races of lower bearing absorb drill and radial thrust. Bore is No. 3 Morse Taper. The Clausing is the only 18" drill providing all these features for greater tool and job capacity.



The spindle is special tough precision-ground steel, $6\frac{3}{64}$" in diameter. Bore is No. 3 Morse Taper. Spindle travel is $6\frac{1}{2}$". The larger spindle provides larger tool capacity—the longer travel gives MORE JOB capacity and greater efficiency on production operations using quick-release chucks.



You can move BOTH the head and table with the Clausing positioning mechanism—an exclusive feature that reduces set-up time to a minimum.

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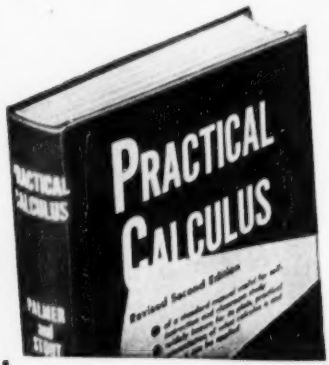

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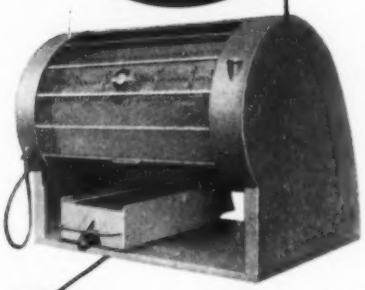

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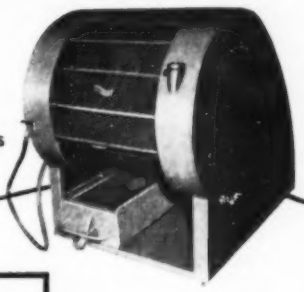

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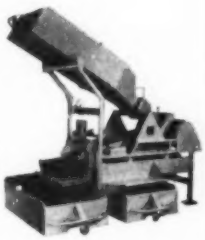

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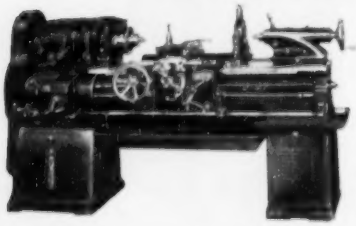

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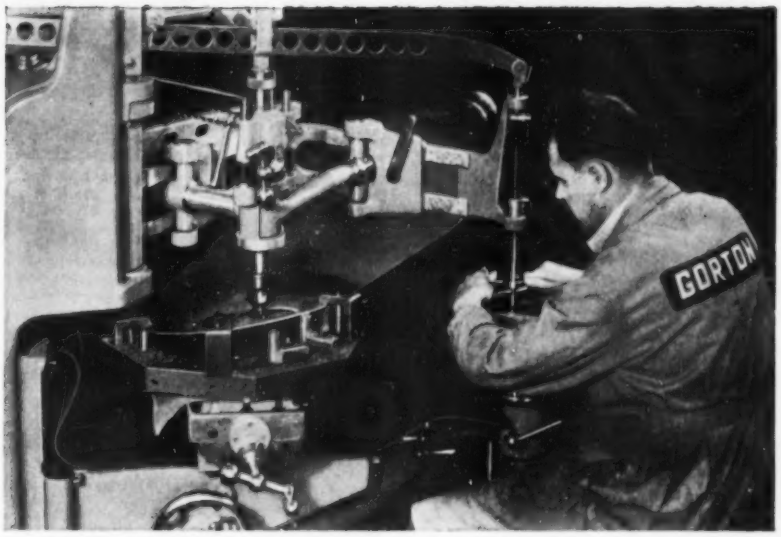

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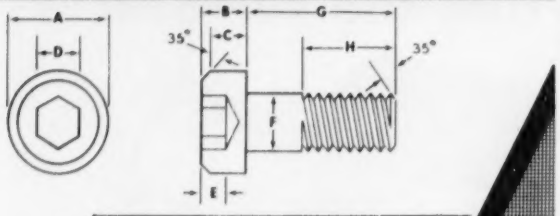
Hexagon Swivel: Hexagon nut with precision-fitted shoe. Available for any type or size screw.

Swivel Set: Socket-head screw with precision-fitted shoe for use where space is limited. Available in 5/16", ⅜", ½", ⅝" and ¾" dia.; any length, any thread.

Allied Swivel Shoes

Mac-it®
DESIGN ENGINEERING at YOUR Service..



MAC-IT PARTS COMPANY							
MATERIAL SAE 9190 STEEL ALLOY ROCKWELL							
FINISH CHROMIUM PLATING ON STEEL .0 M 9251							
TOLERANCE IN LENGTH THE TOLERANCE IN LENGTH							
A	B	C	D	E	F	G	H
1/16	244	229	185	127	248	5/16	3/16

FASTENER DESIGN

Mac-it socket-head screws, providing strength without bulk, give lighter weight, streamlining, and more secure fastening to equipment you design. Whether the design problem involves standard or special screws, Mac-it will add to the appearance, efficiency and performance of the equipment. Use Mac-it Fastener Engineering Service for all problems involving screws for any type application

MAC-IT PRECISION

The precision manufacture and quality control used in making Mac-it Screws provide users with high dimensional accuracy and uniformity. All Mac-it Screws in both coarse and fine threads are held to a class-3 fit. Mac-it maintains a Fastener Engineering Service for the design, development and production of screws for all types of applications.

DISTRIBUTOR SERVICE

Hundreds of Mac-it distributors from coast to coast are ready to render immediate service in supplying your requirements for standard or special screw products.

MAC-IT SCREW DEPARTMENT
STRONG, CARLISLE & HAMMOND COMPANY
1392 W. 3RD. STREET · CLEVELAND 13, OHIO
Manufactured by Mac-it Parts Co., Lancaster, Pa.

Contact your nearest Mac-it distributor or the Home Office, Cleveland, Ohio, for the Mac-it Catalog No. 49 which contains full technical data.

SIGOURNEY
M-100

THE PRECISION BENCH DRILLING MACHINE

ACCURATE because table and column exactly squared one to the other.
LONG LIFE because of hardened and ground spindles.
SAFE because motor, driving belt and spindles are entirely enclosed.
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MODELS — with 1, 2, 3 and 4 spindles.

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This low cost machine will handle internal keyseating jobs up to 1 in.
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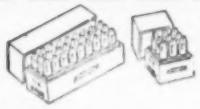

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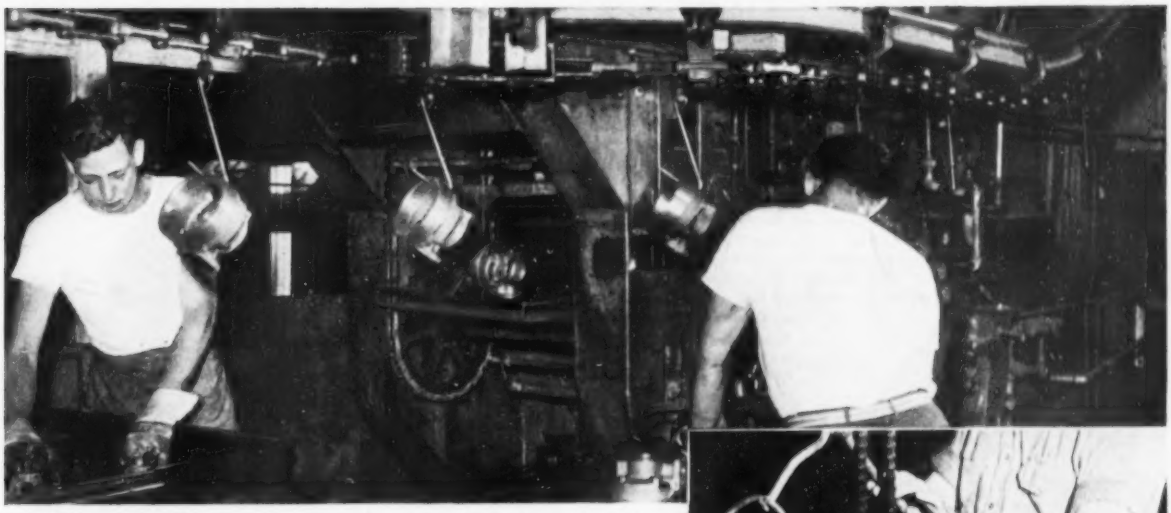

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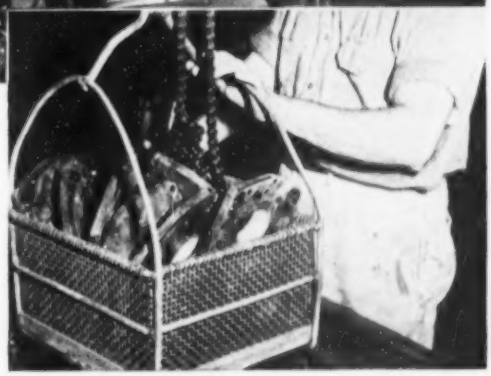
speeds conveyor and manual operations



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Stable and pure "Triclene" D gives excellent results in high-speed degreasing operations—even those involving removal of the newer, chemically active lubricants. Its narrow boiling range permits easy solvent recovery from sludge for efficient re-use. And to help keep your *entire* metal cleaning operation at peak efficiency, Du Pont field men will gladly give you the benefit of their technical experience.

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You'll find complete information on the operation and maintenance of vapor degreasing equipment in these booklets. And interesting, up-to-date case histories about degreasing units in operation throughout the metal field are presented in our publication, "MODERN METAL FINISHING." You can receive this wealth of information by checking the appropriate boxes in the coupon below and returning it to us.

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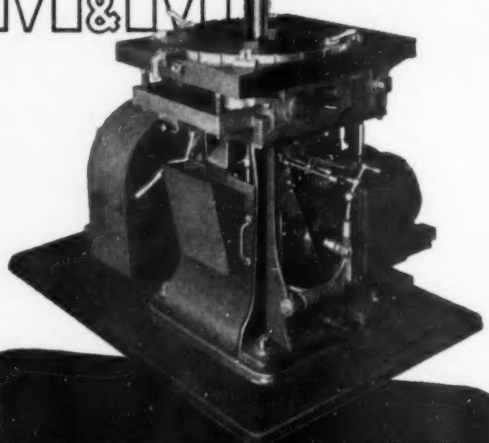

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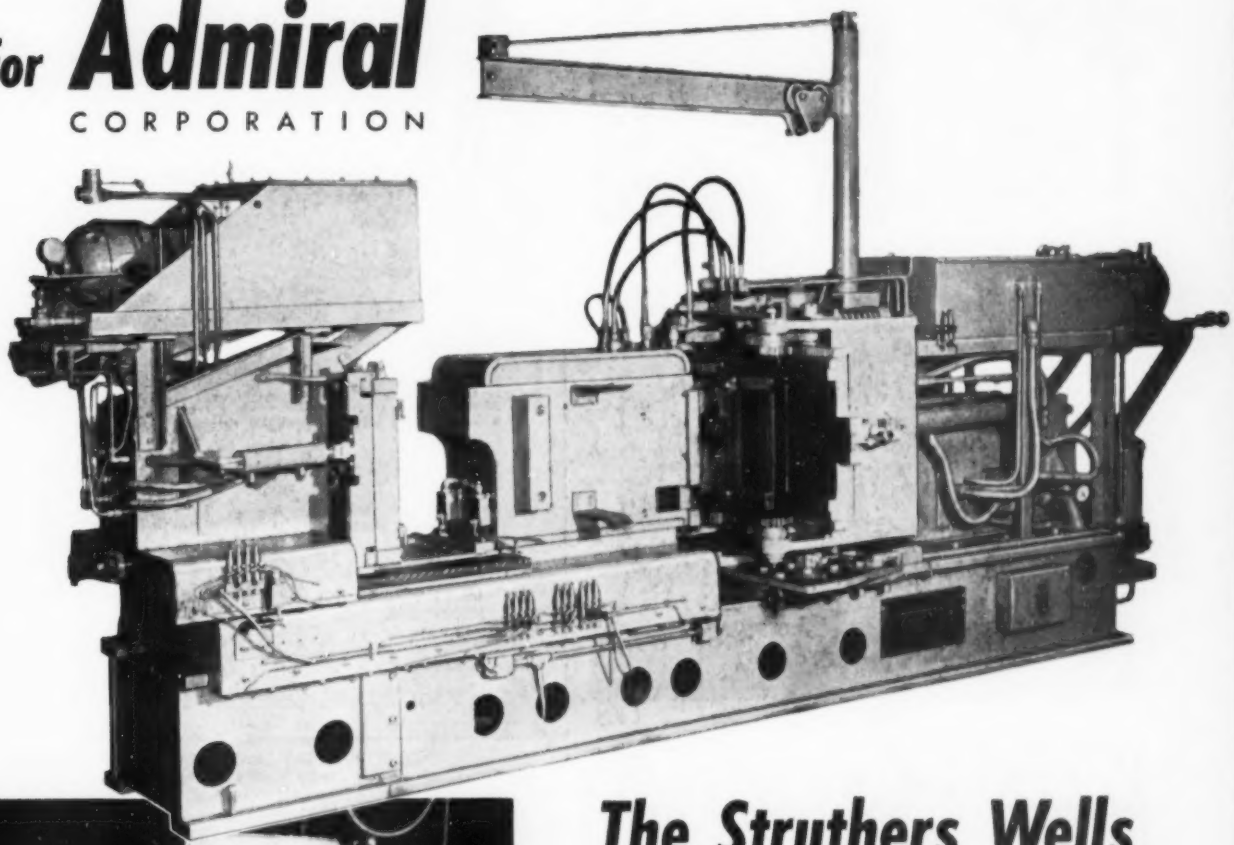

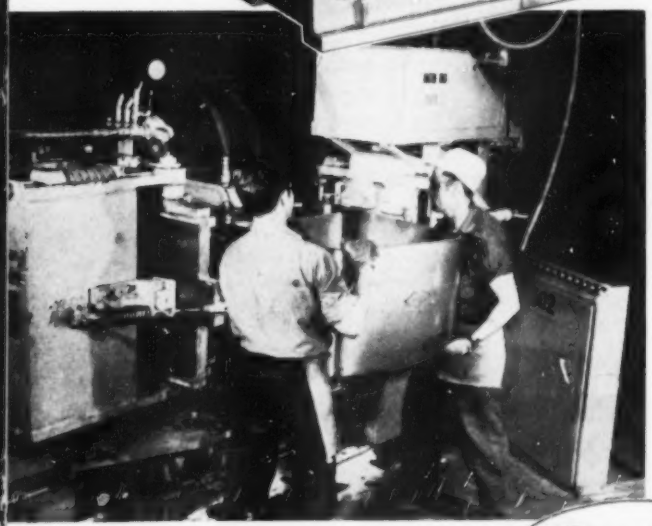

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DOUBLE WING MODEL

Admiral Corporation's appliance production is speeded and costs are lowered by the efficient Struthers Wells Tangent Bender—which forms outer cabinets smoothly and rapidly in a single operation. This powerful machine is in wide use by the household appliance industry for one-piece cabinet forming, radially edge-bending flanges on preformed material, crowning refrigerator tops, doing the whole job! *Write for fully detailed Tangent Bender Catalog.*

The Struthers Wells Tangent Bender at work in the Admiral plant. Auxiliary bender forms bottom in-bent flanges while cabinet is held in main dies—assuring proper side height, saving handling and re-location to other machine.

Struthers Wells

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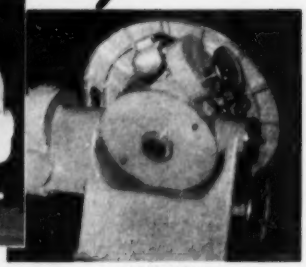
FRONT VIEW


REAR VIEW

The new 48-inch ROTAB

with motor-driven table for fast and easy positioning of work

Now a giant ROTAB!—to give you an extra sized table (48-inch) with benefit of motor-drive to position work fast and easily. The table, with 8 tee slots for clamping work, can be rotated by push of button, and locked to any degree to precision accuracy within 2 min. by vernier graduations. Can also be set from vertical to 30° below horizontal the opposite way.

● The 36-inch model also available with motor drive. Smaller models—12" and 24"—are set manually.

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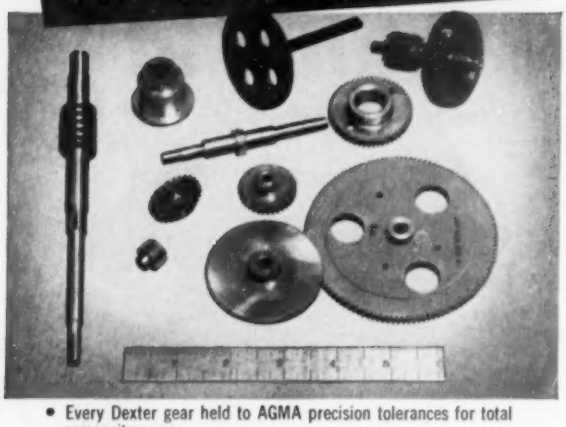

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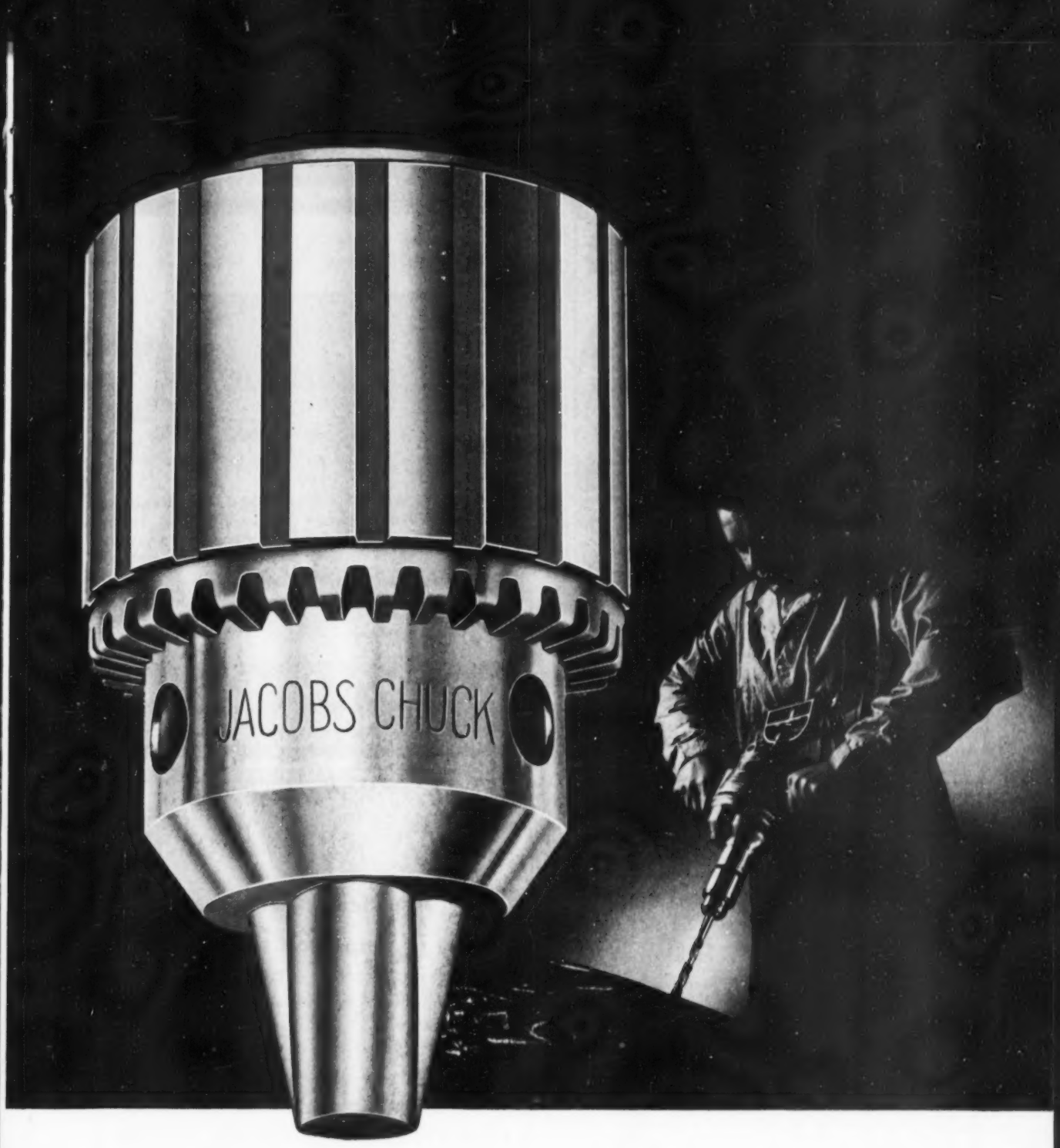

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Production flows faster and smoother when your machine tools are equipped with Jacobs Chucks.

Rugged construction, great gripping power and accuracy have made The Jacobs Plain Bearing Drill Chuck the choice of machinists throughout the world.

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Series

50% thicker column (¾" walls). Greater rigidity counts for closer precision at the chuck. 20% larger quill and deeper head reduces wear from side thrust on deep-hole drilling. 4" or more of the quill is always supported. Rugged steel (not die cast) 6-tooth (involute) splined drive. For more sensitive, powerful quill feed.

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Faster, Smoother Cutting of Any Industrial Material

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Operates at from 92 to 4100 blade f.p.m. Close balance and light, but strong, Textolite wheels permit up to twice the wheel speeds and cutting speeds of other 14" machines. Has the accuracy demanded in tool, die and pattern work. Clears 7¾" under the guide. Strong, one-piece welded steel frame. Entirely enclosed except at cutting point. Blade guides adjust by single control, and with full safety, even when running. Single and 8-speed back-geared models.

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Contour Saw—Band Filer—Belt Grinder

With extreme precision — continuous cutting slice away hard alloys and carbon steels in one tenth the time required by milling, drilling, shaping and hand filing. File broach and remove flash in 1/9 the time required by hand and ¼ the time required by reciprocating filer. 8 speeds. Does all the same types of work that machines costing $1800.00 will do—yet costs less than $500.00.

A Rapid Production Oscillating Spindle-Sander for only $165!

All the important features of high priced machines. For production, patterns, templates, part cleaning-finishing. Sands wood and does internal and external grinding of plastics and metals up to six inches thick. Contours as sharp as ½" radius. (with special equipment down to ⅛" radius). Bevels 0 to 45°. Table 20" x 20", tilts 45° two ways. Handles 1", 1½", 2" and 3" abrasive sleeves. Drum 9" long, oscillates. Ball-bearing throughout. Gears run in oil.

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Feeds ferrous, non-ferrous strip or sheet . . . faster, safer. Use for stamping, shearing. Right or left hand non-slip fitted grip, self-adjusting. Sturdy, hardened work surfaces. FULLY GUARANTEED. Write today. Early delivery.

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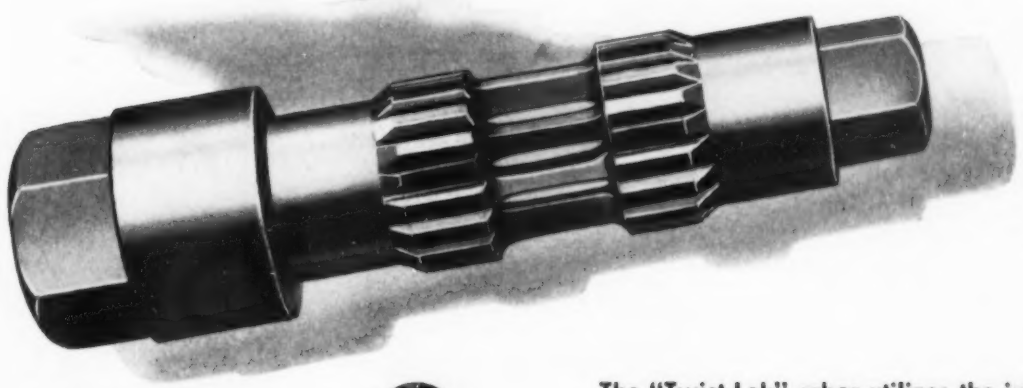
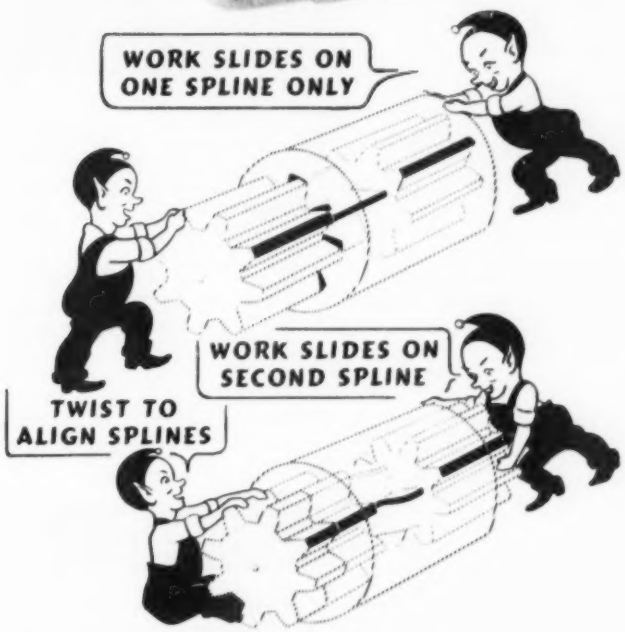
A NEW TWIST IN ARBORS

The Woodworth TWIST LOK *principle for splines*





The "Twist-Lok" arbor utilizes the inherent strength of tough, durable spring steel. There are no moving parts to wear. The Twist-Lok principle insures —

Accuracy you can trust

In a relaxed state, two spline surfaces are finished machined out-of-alignment. A part placed on the arbor goes on the first locating surface easily. With a twisting motion (wrench or air-operated) the reeds are "wound" permitting the spline surfaces to align, and allowing the part to be loaded. The twisting action is released and the part is chucked by the unwinding of the reeds.

One chucking surface is firmly against one wall of the part spline, the other chucking surface is firmly against the opposite wall of the part spline.

Your spline part is chucked securely and on center within a fraction of the concentricity tolerance.

The "Twist-Lok" arbor is additional proof that Woodworth Chucking Specialists have the answer to your chucking problem.

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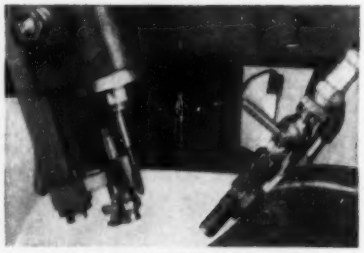
At Last! A Way To Get Uniform Rake Angles On All Taps

The difficulty of regrinding a once-accurate tap to its original rake angle is often responsible for low production per tap and excessively high tap costs. Grinding other taps to the same uniform rake angle has also presented a problem.

A METHOD OF PRECISION SHARPENING

There is, however, one method of sharpening both old and new taps precisely to provide one uniform rake angle —the one which is desired. These excellent sharpening results can be obtained by regularly using the Blake Flute Grinder and the Blake Chamfer Grinder for all your taps. These are the only two machines on the market today that enable you to grind your taps to such true-cutting accuracy. With Blake equipment you can sharpen each tap precisely to provide not only for uniform rake angles on each cutting edge, but also for uniform spacing of cutting edges and accurate chamfers. The Blake method of precision sharpening results in much longer tap life, greatly reduced tap costs, and more accurate finished work.



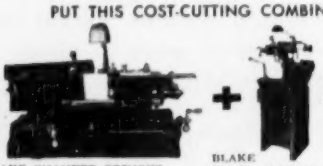
THE HEART OF PRECISION SHARPENING!
Photograph shows close-up of tap positioning mechanism of the Blake Flute Grinder.

READ THE FACTS NOW!

For a detailed explanation of the benefits of precision tap sharpening, write us for the recent *Machinery* article, "Why Taps Should Be Sharpened Precisely". It may prove an eye-opener! Descriptive bulletins on both Blake machines are also available at your request.

IT'S A FACT! YOU CAN REDUCE YOUR TAP COSTS 50 to 75% by installing Blake tap sharpening equipment and sharpening your taps as you do other metal cutting tools.

PUT THIS COST-CUTTING COMBINATION TO WORK FOR YOU NOW!



BLAKE CHAMFER GRINDER (Described in Bulletin 582)

BLAKE FLUTE GRINDER (Described in Bulletin 651)

ACCURATE, TRUE-CUTTING TAPS
LESS TAP BREAKAGE
600% MORE PRODUCTION PER TAP
UP TO 75% REDUCTION IN TAP COSTS

Write for details about both machines!

EDWARD BLAKE COMPANY 435 CHERRY ST., WEST NEWTON 65 MASSACHUSETTS

BLACK DIAMOND PPECISION DRILL GRINDERS...
WALTHAM CUTTER SHARPENERS...SURFACE FINISH STANDARDS

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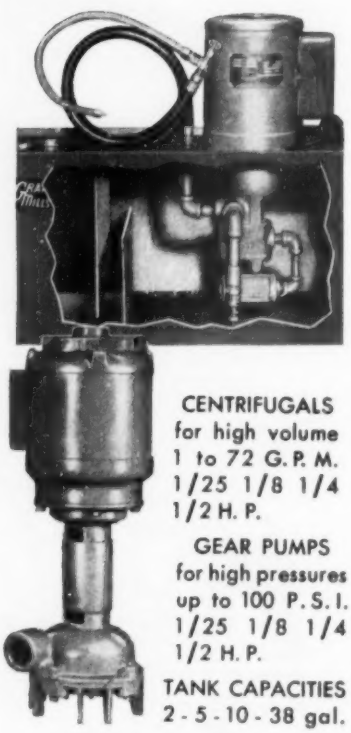

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1/2 H. P.

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for high pressures
up to 100 P. S. I.
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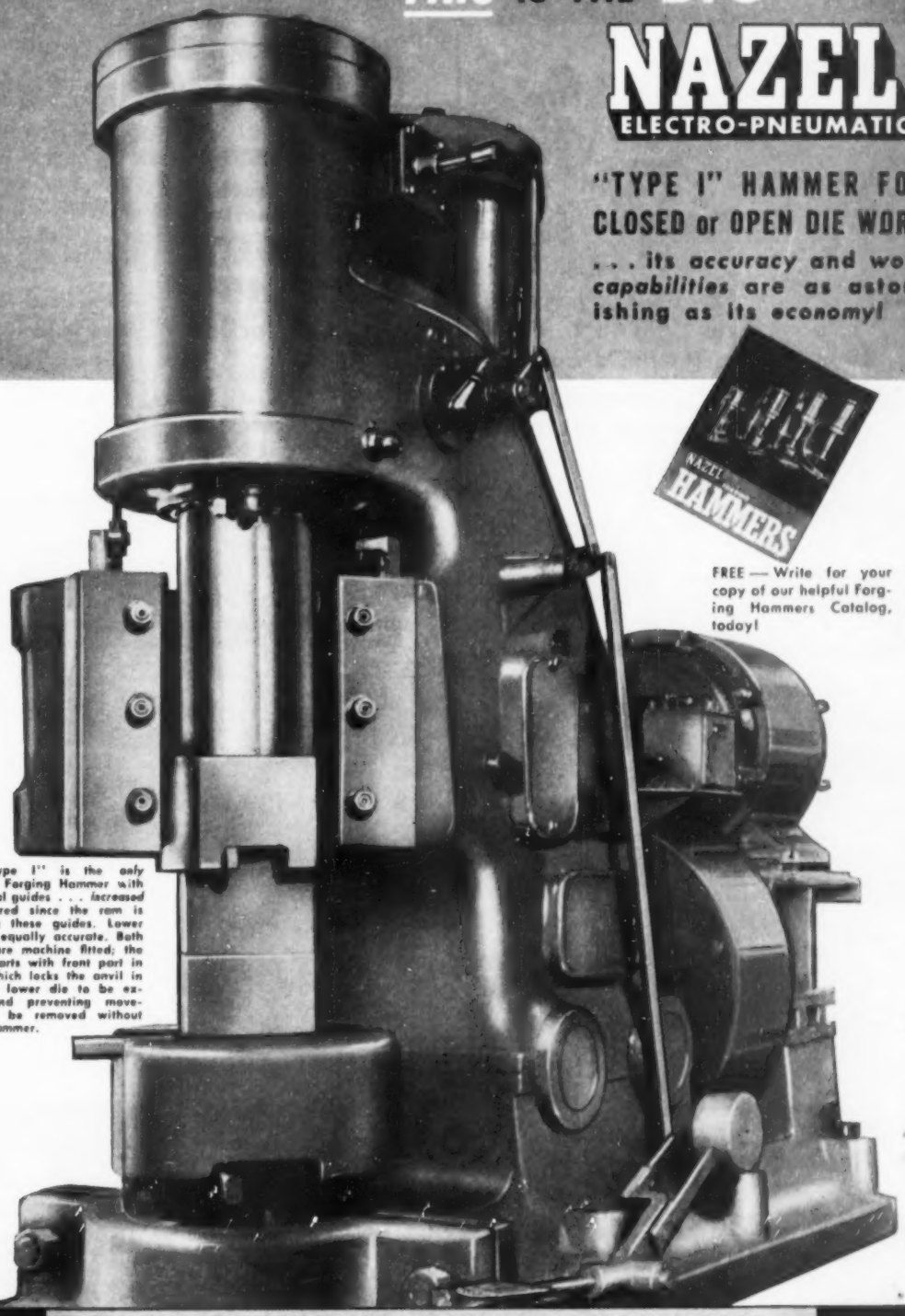
This IS THE BIG NAZEL ELECTRO-PNEUMATIC

"TYPE I" HAMMER FOR CLOSED or OPEN DIE WORK

. . . its *accuracy* and *work capabilities* are as astonishing as its *economy*!

FREE — Write for your copy of our helpful Forging Hammers Catalog, today!



The NAZEL "Type I" is the only Electro-Pneumatic Forging Hammer with adjustable external guides . . . increased accuracy is assured since the ram is held snug within these guides. Lower die alignment is equally accurate. Both base and anvil are machine fitted; the base is in two parts with front part in form of a cap which locks the anvil in place, permitting lower die to be exactly aligned and preventing movement. Anvil can be removed without disturbing the Hammer.

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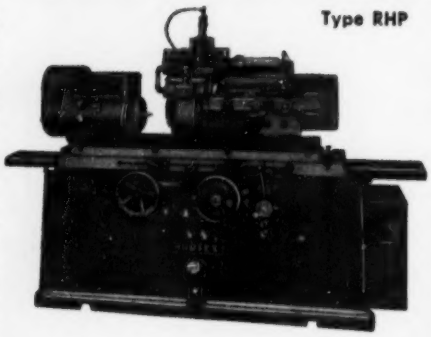
PLAIN GRINDING MACHINE

Type RHP



Fully automatic, the Hartex RHP Grinding Machine is designed for maximum output with accuracy and speed. It grinds material by the longitudinal process and the plunge cut method with wheels up to 6" face. Hydraulic wheel truing device is template controlled.

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PARTIAL SPECIFICATIONS	No. 620	No. 1020
Maximum length ground	24½"	40"
Height of centers	6½"	6½"
Grinding wheel diameter	16"	16"
Maximum table swivel	9°	8°
Work speeds, 9 steps (RPM)	22-500	22-500
Motor, maximum	13½ HP	13½ HP

The maximum rapid return motion is infinitely adjustable from 0" to 2½" by .0001".
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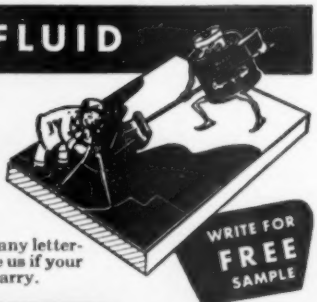

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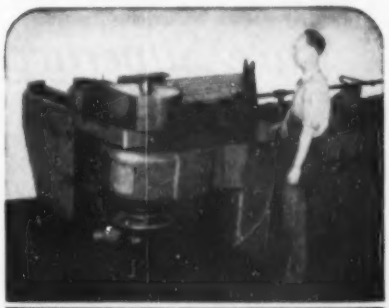
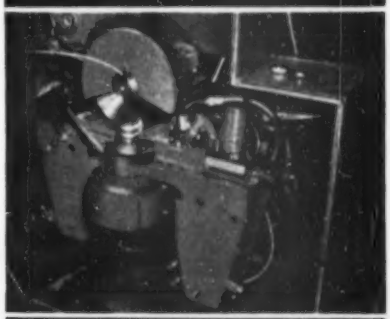
Tooling Set-Ups Engineered To Meet Your Needs

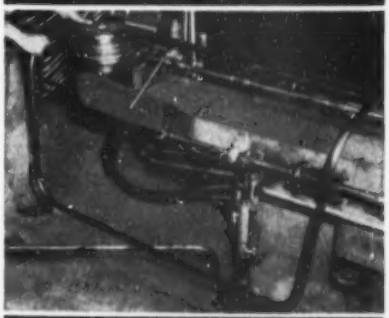
Here are five examples of bending applications illustrating how Pines machines are successfully employed to save time and cut costs on a wide range of bending work. As shown, different tooling setups are engineered and easily applied to handle a variety of production requirements. Hydraulic power, which is used on all Pines Benders, assures accurate, uniform production results and safe, dependable performance. Push-button controls and automatic operation assure high efficiency and production economy. There's a complete range of Pines Benders designed to handle light or extra heavy work, small lot, or high production runs. Call on Pines engineers when you need help with a bending problem. There is no obligation. Phone Aurora 2-7608.



1. MULTIPLE GROOVE DIE — on Pines Size 3 Automatic Bending Machine forms ten 7/16" x 67-1/2" steel rods simultaneously to a 22" radius for farm implements.

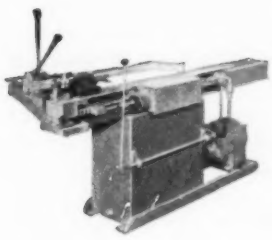


2. DOUBLE DIE AND CUT-OFF SETUP — on Pines Size 3/4 Automatic Bender. Produces 3/4" copper return bends to 7/8" c/l radii automatically, two pieces at a time.



3. TRIPLE RADIUS SETUP — on Pines Size 3/4 Automatic Bender handles three different radii and six 90-degree bends in 1-1/8" tubing in fast sequence. Increases truck seat frame output with less handling.

4. FORMING BLOWER HOUSINGS ON PINES ROTARY BENDER — bends irregular curve (radii of 5-17/32" to 7-3/4") in 5-1/2" width stock at a speed of 89 pieces per hour. Floating bronze pad acts as a wiper shoe, maintains uniform pressure, assures smooth, wrinkle-free results.



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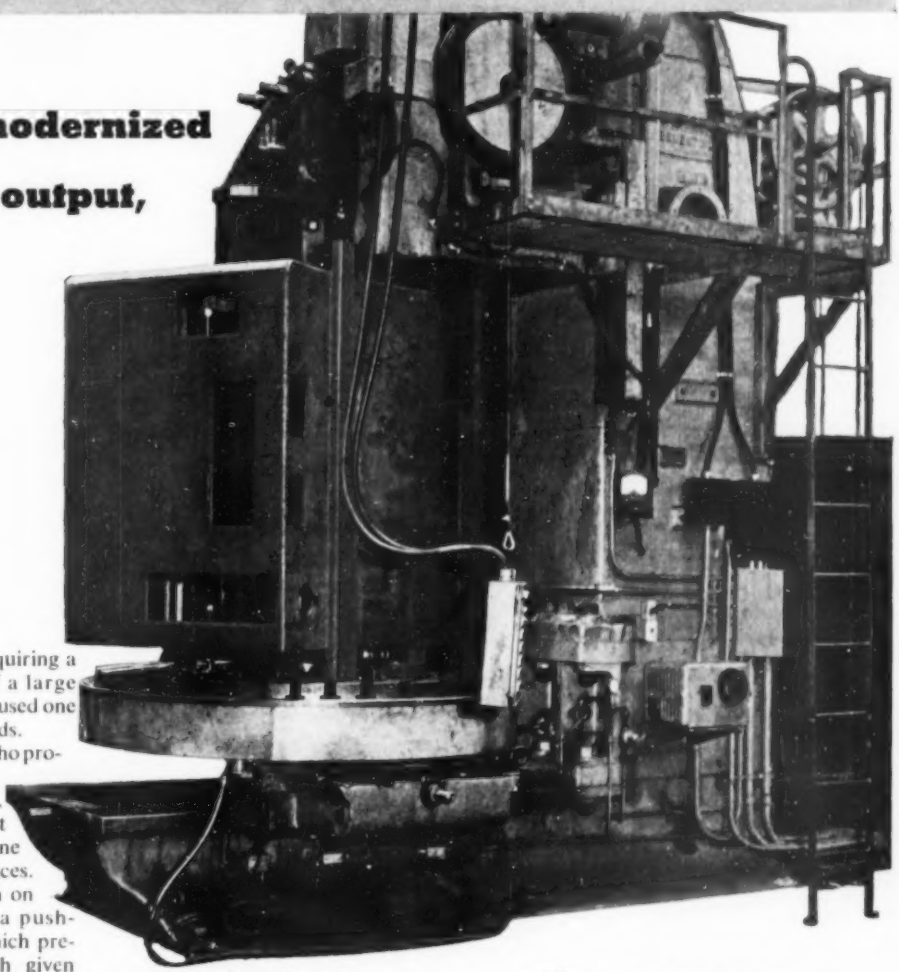

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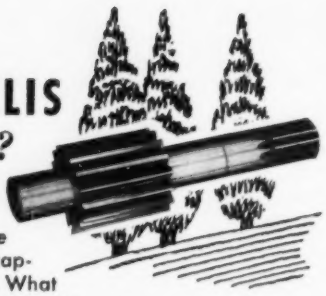

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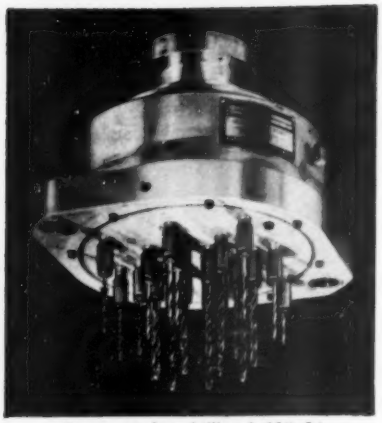

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- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
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- ☐ Has your company given any recognition to donors?
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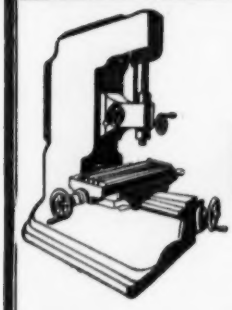

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Gardner or Besly type about 26" wheels to grind two edges of a limited number of steel strips ½" thick 1" wide special conditions make it necessary to do work in our plant therefore desire to rent a machine for two months beginning August.

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1—#2 LMS Leland-Gifford 4 spdle. Step Drill Press, Ser. #3159. Hyd. feed to each spdle., M.D. with A.C. 4 speed motor to each spdle. LATE TYPE.
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1—5 HP AC Pump unit for both machines.

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8" 6 spindle Bullard "A" Multaumatic

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5 ton, 40" Foote Burt duplex surface
10 ton, 56", No. 3XA Oilgear
12 ton, No. V2 American vertical
15 ton 36" Colonial vertical surface
15 ton, 48", No. H10-48 American
18 ton, 42", No. V42 American

DRILLS

21" x 24" Cincinnati
24" Buffalo RPMster
Nos. 217, 321 Baker
No. 36HO Baker, index table
No. B250H Natco, No. 5 taper
3½' American Sens. radial
12 spindle No. 12 Natco multiple
12 spindle No. 39 Natco rail
12 spindle No. 10 Defiance rail
7 spindle Moline Holehog
30 spindle No. 2 Baush
34 spindle No. A16 Natco
No. 7½H-14 Baker two way

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Type A & No. 12 Barber Colman
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No. 12H Gould & Eberhardt
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24", No. 3 Farwell hobber
No. 130 Cleveland Rigidhobber
72" Schuchardt & Shutte hob
72" Westinghouse hobber
4" Gleason spiral bevel
No. 13 Gleason gear tester
10" Pratt & Whitney gear grinder
8" & 12" Red Ring gear shavers
24"x12" Flather auto. spur
Cimatool tooth rounders

GRINDERS

10"x36" Norton Semi-Auto.
No. 2 Cincinnati centerless
21", No. 6-21-1 Besly opposed disc
22", No. 228 Hanchett opposed disc
23", No. 84 Gardner opposed disc
No. 120 Gardner, 1946
53", No. 24 Gardner Horizontal disc
No. 72 Heald Sizematic & Gagematic
Nos. 5, 16A, 16-28 & 24-36 Bryant
No. 42 Van Norman radius
8"x24", No. 78 Wil. & Mor. surface
16", No. 22 Heald rotary surf.
No. 2 Brown & Sharpe universal

MONEY BACK GUARANTEE

LATHES, TURRET

1⅛", No. 601DD Oster
2", No. 5W Acme
2½", No. 5 Gisholt
36" Rogers vertical
36" Bullard New Era vertical

MILLERS

No. 1 Milwaukee vertical, timken, P.R.T.
No. 2A Sundstrand Electromill
18" x 24" Cincinnati duplex
No. 4-36 Cincinnati Hydromatic
No. 2 Cincinnati plain
No. 3B Milwaukee plain
Nos. 32 & 33 Kempsmith Mfg.
Nos. 4, 6 & CT36 Lees Bradner thread
4", No. M80 Taylor & Fenn spline

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AIR COMPRESSOR. 1500' Worthington
BORING MILL. 4" D. & H. floor type
BORING MILL. 72" N.B.P. vertical
COMPARATOR. 20" Portman
HONES. Nos. 172 & 2610 Barnes
KEYSEATERS. Nos. 3 & 4 Mitts & Merrill
LAPPER. No. 10U Norton
PLANER. 30"x30"x10' Cincinnati
PLANER. 36"x36"x10' Niles Bement Pond
SHAPER. 24" American Auto-Oiled
SHAPER. 26" Morton draw-cut
SWAGER. No. 4 Torrington
SHEAR. 8' x 10 ga. Niagara gap

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Bullard 54" "Spiral Drive" Vertical Turret Lathe—Side head—4-jaw chuck table—MD

Betts 8' Vertical Boring Mill—2 swivel heads—69" under cross rail—Actual swing 108"—MD

GEAR CUTTERS

Gould & Eberhardt 96"x30" Automatic Spur & Helical Gear Generator—Auxiliary Table—Power Feeds—MD

Pfauter No. 5 (144"x22") Automatic Spur, Helical & Worm Gear Generator—with end milling attch. for herringbone gears—MD

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V & O No. 1, 2½, 3½, and 4 OBI Power Presses—All MD—Some with Reeves drives and roll feeds—Late type

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Beatty No. 11B 350 Ton Punch Press—Stroke 3"—Wt. approx. 36 Tons—MD—1945 machine

Watson-Stillman 100 Ton Horizontal Forcing Press—Ram stroke 18"

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AUTOMATIC, #00G Brown & Sharpe, M.D.
AUTOMATIC, Cleveland Model #B-1½" Spl. Spdl.
AUTOMATIC, Serial #2 B & S Wire Feed, 1" screw.

BALANCER, Anderson Bros. 14"x64", Roto-Checker.
BORING MILL, 24" Bullard M.D., V.T.L.
BORING MILL, 36" Bullard M.D., V.T.L.
BORING MILL, 36"x44" Niles Vert, M.D., Side Head.
BORING MILL, 2½" Lucas Horiz., M.D.
BORING MILL, 2½" Lucas Horiz. 3" Bar, M.D.
BORING MILL, Giddings & L #0 Horiz. 3½" Bar.
BARRELS, Tumbling Lupomatic, Schutte & Koetring.
BRAKE, #335 Chicago, M.D., Press, 6' 14 ga., NEW.
BRAKE, #185 Chicago Power Apron, 8'x3 16" cap.
BROACH, #3 LaPointe Horiz. 50" Str. M.D.

COMPRESSOR, Ingersoll Rand ER-1, 10 HP. M.D.
COMP., 15 HP, 10 HP, Gardner Denver, M.D., New.
COMPRESSOR, C-P 50 HP, M.D., 10x10, 278 CFM.
COMPRESSOR, Ing.-Rand ER-1, 100 HP Syn. M.D.
CRANE, OET Ricker 2 tons 11'9" span.
CRANE, Canton #8 Portable Gooseneck 3 ton cap.
CHIP WRINGER, 20" Talhurst M.D., Late.
GAS CUTTER, Airco #4 & #10 DB Radiagraph.

RADIAL DRILL, 3' 9" Mueller, M.D.
RADIAL DRILL, 3"x7" Canedy-Otto Cincinnati, New.
RADIAL DRILL, 4'x11" American, M.D.
RADIAL DRILL, 5'13" Cincinnati-Bickford, M.D.
RADIAL DRILL, 5'17" Cinci.-Bick. Super Service.
RADIAL DRILL, 6'x15" Cincinnati-Bickford, M.D.
RADIAL DRILL, 36" Walker Turner M.D., Late.
DRILL, Fosdick 16", S.S. Power Feed, M.D.
DRILL, #2 Colburn H.D. #4 M.T., M.D.
DRILL, #121 Baker Auto. S.S. Cam Operated.
DRILL, Deep Hole, Avey-Draulic #2, M.D.
DRILL, Edlund #2B, 3 spdle. #2 M.T., 16"
DRILL, 4 & 6 Sp. Avey 12" overhang, #3 M.T., M.D.
DRILL, 4 Sp. Barnes H.D., M.D. #4 M.T., P.F.
DRILL, Cincinnati 21" with Tapping Attach. M.D.
DRILL, Natco Multiple Spdle. #12, #1 M.T., M.D.
DRILL PRESSES, Leland Gifford #1MS, 1, 2, 3, 4
DRILL PRESS, #2MS Buffalo Forge single spindle
DRILL, Barnes, 24" S.S. #4 M.T., 1¾" cap.
DRILL PRESS, #25 Foote-Burt S.S. 24", #5 M.T.
DRILLS, #14, #16, #18, Buffalo Forge, M.D.
DEEPFREEZE Motor Products 40 below zero.
DEMAGNETIZER, SB-911 Magnflux, late type.

FACING HEADS, 20" & 24" Mummert-Dixon.
FILER, #11-S Cochrane Bly Auto Saw Filer.

FILER, Type P4, Oliver Floor Type, M.D.
FURNACE, Westinghouse Elec. 18 KW, 2100° F. cap.
FURNACE, Machler Steam Oven, Serial #3543.
GRINDER, M.D. Sanford Surf. 8"x12" cap., New.
GRINDER, #1 Wilmarth Morman Hand Surf., 6"x12".
GRINDER, #2 Imperial Univ. Tool & Cutter, New.
GRINDER, #2 Brown & Sharpe Sur. 6"x18" cap., M.D.
GRINDER, #4 G & L Univ. Tool & Cutter, M.D.
GRINDER, Disc, Besly #205, 16" Dble End.
GRINDER, Heald Rotary #25, M.D., 16" Cap.
GRINDER, Cylindrical, Norton 10"x24", M.D.
GRINDER, Brown & Sharpe #4 Univ. 12"x60".
GRINDER, #13 B. & S. Univ. Tool & Cutter.
GRINDER, Thread, Jones & Lamson #TG-615, Late
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, 14"x36" Pratt & Whitney Vert. Surf.
GRINDER, Pratt & Whitney 22"x84" Vert. Surface.
GRINDER, Greenfield #12 Int. Hydromatic, M.D.
GRINDER, Oliver Auto. M.D. Drillpointer, #510.
GRINDER, #33 Abrasive Vert. Auto. Surface, M.D.
GRINDER, #22 Heald Horiz. Rotary Surface, M.D.
GRINDER, Diamond Snagging 10 HP, 24"x4½".

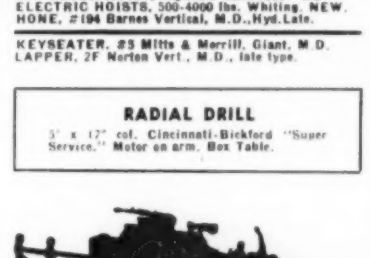
LANDIS 6 x 18 Hyd. Cyl. Grinder, Type C. Serial #29196.

GRINDER, Norton 6x18 Vert. Surface, Hyd. Late.
GRINDER, #60 & #70 Heald Internal.
GRINDER, Landis 6"x18" Hyd. Cyl. late type, M.D.
GRINDER, Sellers Type #1A Tool, 24" wheel.
GRINDER, 37" Wheel Dia. Osterheim Disc, 24" cap.
GRINDER, 30" Ingersoll Tub Face Mill, M.D.
GRINDER #79-72" Gardner Vert. Spindle, Late.
PROFILE GRINDER, Studer Type PSM, M.D., late.
GEAR SHAPER, Fellows #6 High Speed, M.D.
GEAR SHAPER, Fellows #7 High Speed, M.D.

HAMMER, Rochester Hispeed, all sizes, M.D.
HAMMER, Bradley 200# Rubber Cushioned Helve.
HEADER, Manville #1 S.S.D.D. Cold 3/16".
INDUCTION HEATER, 15 KVA Ecco Hi Frequency.
INDUCTION HEATER, 30 KW Lepel, Late Type.
AIR MOTOR HOIST, Ingersoll Rand 2000# cap.
ELECTRIC HOISTS, 500-4000 lbs. Whiting, NEW.
HONE, #194 Barnes Vertical, M.D., Hyd. Late.

KEYSEATER, #5 Mitts & Merrill, Giant, M.D.
LAPPER, 2F Norton Vert., M.D., late type.

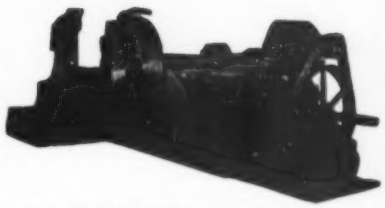
RADIAL DRILL
5' x 12" col. Cincinnati-Bickford "Super Service." Motor on arm. Box Table.



#4 WARNER & SWASEY Geared Head Turret Lathe, Motor Driven, Bar Feed, Taper Attachment.

LATHE, Lo-Swing 8"x108", M.D., A.C. Rebuilt.
LATHE, Porter-Cable 9'x15" Geared Head Prod.
LATHE, Hendey 12"x5' Q.C.G. Taper Attach. M.D.
LATHE, LeBlond 14"x6', Q.C.G. M.D.
LATHE, Hendey 14"x8', Q.C.G. Taper Attach. M.D.
LATHE, American 16"x6' Q.C.G., Grd. Hd. M.D.
LATHE, Lehman 18"x7' Q.C.G., M.D.
LATHE, American 18"x10' Q.C.G., Grd. Hd.
LATHE, South Bend 18/28"x8' Gap Bed, Q.C.G. M.D.
LATHE, Hendey 20"x10' Q.C.G., Taper Att. M.D.
LATHE, Reed-Prentice 20"x10' Grd. Hd. M.D.
LATHE, LeBlond 22"x10' Q.C.G., M.D.
LATHE, 24"x12' Boye & Emmes Grd. Hd., T.A., Late.
LATHE, Putnam 23/32"x12' Q.C.G., M.D.
LATHE, LeBlond 24"x14' Q.C.G., Grd. Hd.
LATHE, Lodge & Shipley 26"x14', Q.C.G., M.D.
LATHE, Bridgeford 27"x12' Geared Head, M.D.
LATHE, 27"x16' Niles Timesaver, Grd. Hd., M.D.
LATHE, Bridgeford 32"x16' Q.C.G., Grd. Hd.
LATHE, 42"x10' Pittsburgh Geared Head, M.D.
LATHE, Buffing Dble. End #VMT5, Devine Bros.
LATHE, Turret #1 Bardons & Oliver Electric Head.
LATHE, Turret, #2 Simmons Vari Drive 220 V.
LATHE, Turret #2 W & S Univ. Grd. Hd., Late.
LATHE, Turret, #4 Warner & Swasey Univ. 1½".
LATHE, Turret #4DE Potter & Johnston Auto., 1942.
LATHE, Turret #6 Warner & Swasey Grd. Hd. Ram Type, Bar Feed, Motor in base.
LATHE, Turret #2 Cinci. Acme Univ. Geared Head.
LATHE, Turret, #3A Warner & Swasey Univ. M.D.
LIFT TRUCKS, Baker 1 & 2 ton, Platform & Fork.

MILL, #4 Burke Motor Driven, Late, M.D.
MILL, #2 Pratt & Whitney Prod. Duplex, M.D.
MILL, #3VB Hardinge Vert. Bench, M.D.
MILL, #4B Brown & Sharpe H.D., Horiz. M.D.
MILL, #14 Garvin Plain Horiz., M.D.
MILL, #0Y Brown & Sharpe Plain Horiz., M.D.
MILLING MACHINE, #2B K & T Horiz., M.D.
MILL, Cinci. Horiz. #3, #4, #5 High Power, M.D.
MILL, #1 Brown & Sharpe Plain Horiz., M.D.
MILL, #0-B Cinci. Vert. Prod. Late, M.D.
MULT-MILLER, U.S. Tool #MM-1-G Auto. Prod.
MILL, #0 Douglas Plain Horiz. M.D., Coolant.



No. 700 ESPEN LUCAS Hydraulic Heavy Duty Cut-off Saw, new 1945.

MILL, #0 Vernon Hand Mill, M.D., Late.
MILL, 2A Brown & Sharpe Horiz. Univ., M.D.
MILL, #2BP Van Norman Horiz. M.D., Late.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILL, #3 Dine, Univ. Horiz., M.D.
MILLING MACHINE, LeBlond #4 Horiz. Univ.
MILL, #2 Vert. M.D. Brown & Sharpe.
MILL, #3 Cinci. Vertical Hi Power, M.D.
MILL, #3C Becker Vert. Dio Sloker, M.D.
MILLING MACHINE, #2 Van Norman Duplex, M.D.
MOTOR GENERATOR SET, Gen. Electric, 100 K.W.

NIBBLER, Gray Turret Type ¼"x24" cap. M.D.
THREADING, Staybolt Lassiter Millholland 1½".
THREAD MILL, 2½x11 Hanson-Whitney, Univ.
THREAD MILL, 6x14 Pratt & Whitney No. 1105.
THREAD MILLER, Lees-Bradner #40A Automatic.
THREAD MILLER, Pian-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, Late.

PAPER SHREDDER, No. 10 Mitts & Merrill, M.D.
PLANER, Cincinnati 30"x30"x12' A.C., M.D.
POWER PRESS, Bliss #164 Open Back, M.D.
POWER PRESS, Bliss #3A S.S. Dble. Crank Grd. 45 tons, 4" stroke, 36"x26" Bed Area, M.D.
POWER PRESS—Bliss-Consolidated #163-B Straight Side Dble. Crank 45 tons, M.D.
PRESS, #5 Johnson OBI, 56 tons, new.
PRESS, #7 & #8 Johnson OBI 70 & 80 tons, New.
PRESS #163 Toledo Toggle Drawing, M.D.
PRESS, 135 Ton Clearing Single Crank S' Str., Late.
PRESS, 70H Drake Hyd. Arbor, New.
PRES. 75½ Bliss S.S. 9½ Str. M.D.
PRESS, Federal #2 O.B.I. Grd. 2" Stro.
PRES. Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRES. Waterbury-Farrel High Speed 60 tons #3W.
PRESS, 60 C Bliss Double Action, 3 crank.
PRESS, Lucas 15 tons Power Arbor, M.D.
PRESS, #68 Whitney Deep Thr. 24", feed.
PRESS, P2, P3 Ferracute M.D. Roll feed.
PANTOGRAPH, #1A Gorton M.D. Engraving.
PUNCH, #46 Buffalo Forge Vert. Can. 1"x1¾" M.D.
PUNCH, R-4 Wiedemann Turret, 10 Stat. 24" thr.
PUNCH, Hacker Turret, 8 station, cap. 2½" hole.
PUNCH, H & J #2 Sqle. End, 24" Thr. 1" thru 1".
PUNCH, H & J #4, 48" thr., with Shear Blades.

RIVET SETTER, ¾" cap. Penn. Tubular Rivet.
ROLLS, Bertsch Pyramid 18'x1¾" cap., M.D., Late.
ROLLS, #1 Buffalo Forge Wrapping, M.D.
ROLLS, 72"x¼" Lown initial M.D., New.
ROLLS, #7 Buffalo Forge Vert. Angle, Bending, New.

COLD SAW, Wagner 10"x10" cap., M.D.
COLD SAW, Espen-Lucas #700, 48" dia. blade, M.D.
CUT-OFF SAW, Yates-American #M-90, M.D.
SAW, #4B Marvel Hack Saw 6"x8" Cap., M.D.
SAW, #20-C Racine Shear Cut 6"x6" cap., M.D.
SAW, Band Tannewitz GH-36" High Speed, M.D.
SAW, V-20 DoAll Contour Band, Late.
SHAPER, 16" Pratt & Whitney Crank, M.D.
SHAPER, 20" Rockford Univ. M.D., Tilting Table.
SHAPER, G & E 24", high duty, back geared, M.D.
SHAPER, 32" Cinci. B.G., Motor driven, H.D.
SHAPER, Morton 36" Draw-Cut, 4-Speed, M.D.
SHEAR, #642 Niagara 42"x½" cap., 15° cap., M.D.
SHEAR, #26 Buffalo Forge Slitting Armor Plate.
SHEAR, Quickwork #11 Rotary 60" Throat 10 ga.
SHEAR, 10' x 10 ga. Wysong & Miles, M.D., New
SCREW SLOTTER, #2 Waterbury Farrel Auto. M.D.
SLOTTER, 12" New Haven Vertical, M.D.
SPRU CUTTER, Milwaukee 56 tons, 2½ cap. M.D.
SURFACE PLATES & TABLES, all sizes.

TAPPER, #1 CAM Hoskins, Motor Driven, Late.
TAPPER, #1 Bakewell (Warner & Swasey) Late.
TRUCK, 2000 lb. Hyster Fork Lift, 9' Model GT-20.
TRUCK, 4000 lbs. LT-44 Towmotor Fork Lift 8'.
BRINELL, Tester Machine, Type UK300M, Steel City.
BRINELL, Tester Machine, Type 03DR, Steel City.

WELDER, 500 amp. Westinghouse Flexarc A.C.
WELDER, 200 & 400 amps. Gas. Elec. Portable Arc.
WELDER, 200 KVA Federal, Projection.
WELDER, 75 KVA Federal, M.D., Spot.
WIRE STITCHER, Merrion and Acme, M.D.

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SOUTHWARK 20' x 1". Drop end, balance bar motorized.

PLAIN MILL
KEARNEY AND TRECKER — Model 2HL plain horizontal 1943.

PRODUCTION LATHE
SENECA FALLS Model LR, Lo-Swing, Front & Rear Slides, Tailstock, 1942.

TURRET LATHE
GISHOLT 1L saddle type heavy duty bar feed chucking 1944.

CYLINDRICAL GRINDER
CINCINNATI 10"x48", Mod. ER, Servo Infeed, 1941.

PLUNGE GRINDER
BROWN & SHARPE—No. 5 3" x 12" plain cylindrical with plunge grinding 1942.

PRODUCTION MILL
KEARNEY & TRECKER 1H—18" Manufacturing Mill. Climb Milling, Auto. Spindle Stop, 1941.

TURRET LATHE
WARNER & SWASEY No. 2 12 speed geared head. Power bar feed 1941.

CYLINDRICAL GRINDER
CINCINNATI 10"x36", Mod. ER, Servo Infeed, 1942.

PLUNGE GRINDER
LANDIS Mod. 4H, 4"x18", Plain Cylindrical, with Plunge Grinding, and Automatic Timer, 1943.

SHAPER
GEMCO—20" Universal power down feed power rapid traverse 1946.

VERTICAL MILL
KEARNEY AND TRECKER 2K. 4 position turret stop 1943.

GEAR HOBBER
BARBER COLMAN type "A" 1943.

PRODUCTION LATHE
SUNSTRAND 12A Automatic, Front & Rear Slides, Air Chuck and Air Tailstock, 1951.

TURRET LATHE
GISHOLT 2L saddle type pre-selector head cross sliding turret bar and chuck 1942.

MULTAUMATIC
BULLARD 12" 8 spindle type "D" well tooled power chucks. 1941.

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#145 Cleveland RIGIDHOBBER.

#81 Heald INTERNAL CENTERLESS GRINDER.

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75 SANFORD STREET at R.R.Station Phone FAIRFIELD 9-3321 FAIRFIELD,CONN.

LATE MODEL TOOLS

American Type T-6-32 Broaches Three-way vertical hydraulic, single ram, 13"x18" table. Cap. 12,000#. MD with 7½ HP motor. 1942.

Barrett 1 ton Portable Shop Elevator Hinged type. Never used. Half price.

No. 320 "Barnesdrill" Multiple Cyl. Hyd. Hone, throat—16¼", spindle stroke 2" to 20", 5" dia. spindle. Sleeves with #4 taper. 1948.

RAVINE, INC
new and used machinery
652 W. Willis Ave., Detroit 1, Mich.

No. 2 B & S High Speed Autos. M.D.
Hardinge Model MD-37 Lathe, ½" cap.
No. 7 Gleason Cutter Sharpener.
Laidlaw 30" Type CMT Metal Band Saw.
D. E. DONY MACHINERY CO.
47 Laurelton Rd., Rochester 9, N. Y.

HENDEY 14 x 54 LATHE
Late Type — 1943
Complete with Collets, Taper Attachment, Etc.
EXCELLENT CONDITION
WINSTON MACHINERY COMPANY, INC.
326 W. Ohio St. Indianapolis 2, Ind.

NEARLY NEW (1948)
GLEASON #7 HYPOID CUTTER SHARPENER. Ser. #24768. Hand Index, Hand Feed. Coolant.
W. C. COWDEN MACHINERY CO.
1207 W. Genesee St., Syracuse 4, N. Y.
Phone 37787

WORLD'S LARGEST INVENTORY
FREE CATALOG
ELECTRIC EQUIPMENT CO.

1941-1953 MACHINE TOOLS

IMMEDIATE DELIVERY — NO PRIORITIES NEEDED

CAM MILLERS

VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

CENTERING MACHINES

SUNDSTRAND: 44" Double End Centering Machine

CUTTER & TOOL GRINDERS

FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: 10" Template Tool Bit
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), automatic indexing

DRILLING MACHINES

ALLEN: #2 High Speed, 15" overhang
PRATT & WHITNEY: ⅛B x 50 Deep Hole Drilling & Reaming Machine, 2-spindle
SUNDSTRAND: 44" Double End Centering Machine

GEAR CUTTING MACHINES

BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D. P. capacity
CLEVELAND: Model 130 Gear Hobber (like new)
CLEVELAND: Model 140 Gear Hobber (like new)
FELLOWS: 61A Shaper, 18" dia.
FELLOWS: 64A Shaper, 18" dia.
FELLOWS: 72 Shaper, 7" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
GLEASON: 3" Straight Bevel Gear
SYKES: Gear Shaper 14" external, 20" internal (New)
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)

GEAR AND SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x 24" Hydr. Spur Gears and Splines

GEAR FINISHERS & TESTERS

FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 4 and No. 6 Bevel Gear Testers. Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 10 capacity 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, Plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 10"x18" 45° angle wheel

3-WAY GUARANTEE

1. Should any machinery purchased from us prove unsatisfactory, you can return the machines within 30 days, via freight prepaid to our plant, and a full refund will be made.
2. Machines at our plant can be demonstrated and tested under power before purchasing.
3. You are dealing with a well-established, highly-rated firm of machinery engineers with over 33 years of proven responsibility.

GRINDERS—GEAR & SPLINE

GEAR GRIND MACH.: GG-19, 10"x 24" Hydr. Spur Gears and Splines
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed

GRINDERS—INTERNAL

BRYANT: No. 5Y Internal
HEALD: 72A3 Sizematic Centerless

GRINDERS—RADIUS

VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #639, capacity 7"
VAN NORMAN: #649, capacity 6" to 16" diameter
VAN NORMAN: #3½ Un. Radius

GRINDERS—THREAD

EXCELLO: #31 External, dia. 5"x18"
JONES & LAMSON: #636 Universal, 6" dia. x 36" centers and one extra multiform wheel dressing attachment

HONING MACHINES

MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia.

JIG BORING MACHINES

LINDNER #14 & #15 Jig Borers, new

LAPPING MACHINES

FELLOWS: 8LSI and 13 LSI Gear Lappers, external and internal spur and helical

LATHES PRODUCTION

BLOUNT: Polishing speed lathe 12" dia. x 48" centers
H.E.B.: High production hydraulic duplicating and copying lathes (new)
LODGE & SHIPLEY: #3A Duomatic. 25½" swing x 27" centers
POTTER & JOHNSTON: #6 DREL Automatic
PROGRESS: Geared head 16" to 30" swing (New)
New Engine Lathe 49" swing x 20' centers
New Engine Lathe 27" swing x 23' centers

LATHES—TURRET

WARNER & SWASEY 2A Turret Lathe
WARNER & SWASEY #3 Turret Lathe
HERBERT: #2, #4, #7, and #8 Sizes (new)
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)

MILLING MACHINES

TAYLOR-FENN: M-80 Duplex Spline
RICE-BARTON: Duplex Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

SAWS & CUT-OFF MACHINES

CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)

THREAD MILLERS & TAPPERS

HALL PLANETARY: Model "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: 40A Thread Miller
MURCHEY: #22 Horizontal threading and tapping machine, ⅛" to 2⅛" dia. capacity, single spindle
NATCO: Vertical Tapper 16 spindle

WIRE FORMING MACHINES

BAIRD: 4-slide wire former
HEENAN & FROUDE: Wire forming, 4-slide machines (new)

MISCELLANEOUS

CUTOFF: Campbell, abrasive 425 Cutalator 4½" dia. Capacity
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Russell 5½ & 9½" cut-off saws with auto. stock feed (new) hydraulic
TEST STAND: Denison 918-AM Hyd.
LATHES: Blount Polishing Speed Lathe, 12" dia. x 48" centers
GOGAN BRINELL Hardness Tester Model 16-J
SHAPERS: Klopp 16 to 26½" (New)
SHAPERS: Hercules 16" & 22" (New)
SUNDSTRAND: 44" Double End Centering Machine
WIRE FORMING MACHINES: 4-slides (new)

INSPECTION INVITED — Telephone HAnover 2-4520

TRIPLEX MACHINE TOOL CORP.

75A West Street, New York 6, New York **Cable Address TRIMACTOOL**

MACHINE TOOL ENGINEERS SINCE 1919

RELIABILITY has been earned by
WIGGLESWORTH MACHINE TOOLS

AUTOMATICS
2½" Cone 4 spdle., well equipped, 1936
#24 New Britain 4 spdle. chucker, 2½" cap
¾" Model F Gridley, 4 spdle.

2" 4 SPINDLE CONEMATIC, THREADING SPDLE., TAPPING ATTACHMENT, BAR FEED, CONSIDERABLE TOOLING. EXCELLENT CONDITION. 1943

BORING MILLS
42" Bullard New Era, rail & side head
No. 40 Landis floor type, 4" bar, rebuilt

GRINDERS
#1½ G & L Univ. T & C, 1945
#76HA Rogers knife grinder, 76", late
Cinn. internal, 24" swing, 78" stroke
16x42" Landis Type D Crank Pin
14" Hammond WD carbide tool, late
14x120" Landis plain cylindrical
#104 Rivett Universal, 1942, rebuilt
#4 Bryant Internal, auto. sizing
#70A Heald plain internal, 1940

No. 5 B & S cylindrical, 3x12" late
#33 ExceHo ext. groove, late type
#86—30" Gardner vert. disc grinder
14x36" Norton C semi-auto., cyl.
73 Heald Internal Centerless
73 Heald Internal, 1944, like new
P & W deep hole drill grinder, late
Model 1311 P & W contour, late

DRILLS
Baker Hvy Dty, #5 M.T., p.f.
6'17" Carlton radial, DC motor, late
#2LMS Leland-Gifford, 26", hydraulic
#2 Allen, 2, 4, 6 spdle., #2 M.T.
Type 14 Natco 12 spindle
Model 4230 Bodine Drill & Tapper, 12 sta
Moline Hole Hog, 2 spindle

GEAR MACHINERY
6" Gleason straight bevel generator
13LS Fellows lapper, late
7A Fellows, shaper high speed, hvy dty
61A Fellows, shaper, high speed precision

LATHES
42"x26' ctrs American, High Duty, 16 speeds
30"x10' American geared head, taper att.
42"x25' American Hvy Dty, 2 carriages, late
48"x35' LeBlond Hvy Dty, taper, late
Gisholt Simplimatic, platen type, late
33" Niles vertical wheel lathe, 1930
48" Niles vertical wheel lathe, 1930

TURRET LATHES
#1A W & S Univ., 3" hole, #417,756
#1L Gisholt Universal, 3" hole, 1937
Libby type H, 24" swing, 8 spds., speeds
#4 W & S plain, Timken, #327217
#2 Simmons Microspeed, air chuck, late
#3 Gisholt Universal, late

SHAPERS & PLANERS
30"x30"x17' Cleve. Openside
48x48x14' Detrick & Harvey dble. hsg.
26" Smith & Mills shaper, 4 step cone

MILLS
08 Cinn. horiz., auto. cycle, 1943
Briggs production, hydraulic, 12x42" tble
#1½B K & T horiz., dble. overarm, rebuilt
10C Van Norman Contour

THREADERS
8x16" Hanson-Whitney Universal, mill, late
6x80" P & W miller, splining & milling
Lees Bradner Model B Cridan, late
#50 Excello Precision grinder, 28x68"
13" Automatic Machinery miller, late
#2 Dalzen grinder, 3" o.d. cap., late
LT636 Lees Bradner mill, 18 x 36", late
1½" Landis, 2 spdle., lead screw type

FURNACES
Whiting Converter, 2 ton cap., late
Model SP Juthe, gas, 1000° F
Lithdraw heat treat, 1200° F, late

PRESSES
#12 Zeh & Hahnemann precussion, 150 ton
#78½ Bliss straight side, 350 ton, sgle. crank
Ferracute type EG-52 embossing, 150 ton
Lucas 50 ton straightening, 24½" stroke
#57 Toledo, 150 ton, s.s., S.c.
#4 Toledo OBI, 25 ton, 2" stroke

MISCELLANEOUS
TAPPERS: Haskins 2CAM, 5/16", late
Cleve. Model EO, ½", late
BROACH: XL12 Oilgear, 60" stroke
WELDER: 75 KVA Federal spot, PA-1-18
KEYSEATER: #6-38 Mitts & Merrill, 4 x 36"
SPINNING RIVETER: Grant 5 spdle.
HAMMER: 300# Bradley Upright Helve
WELDERS: Hobart and P & H Arc, 400 amp.
BULLDOZERS: #2 Ajax High Speed, 30 ton

T. R. WIGGLESWORTH MACHINERY COMPANY
1719 SUPERIOR AVENUE • • • SUPERIOR 1-8727 • • • CLEVELAND 14, OHIO

LATE MODEL MACHINE TOOLS . .

AUTOMATICS
3½" RA-4 Acme Gridley, 1940
2" Model A Cleveland, 1941
1⅝" Model A Cleveland, 1943
1-1/16" Model A Cleveland, 1943
No. 00G Brown & Sharpe, 1941

BOREMATICS
No. 49 Heald Single End, 1941

BROACHES
HP-100 La Pointe Horiz. Broach, 1945
5 Ton 36" Stroke La Pointe Vertical, 1942

DRILLS
No. C225H Natco Multi. Spdl. 1942
No.6 Avey 4 Spindle, H.F. 1943
Allen Single Spindle Drill & Tapper, 1942
No. 2 LMS Leland-Gifford, H.F. 1942

GEAR EQUIPMENT
No. 7 Gleason "Revex" Rougher, 1943
No. 6 Gleason Revacycle Generator, 1940
No. 72 Fellows H.S. Gear Shaper, 1942
10" Pratt & Whitney Hyd. Gear Grinder, '42

GRINDERS, CYLINDRICAL
14"x168" Norton Plain Type "C", 1942
12"x66" Fitchburg Plain Hyd. 1942
12"x48" Cincinnati Univ. Grinder, 1942
10"x18" Norton Plain Type "C", 1940
6"x30" No. 12 B&S Hydraulic, 1940
No. 5 Brown & Sharpe Plain, 1941
No. 2 Cincinnati Centerless Grinder, 1944

GRINDERS, INTERNAL
No. 72-A3 Heald Plain Hydraulic, 1942
No. 24-36 Bryant Hydraulic, 1943
No. 16 CP 16 Bryant Hydraulic, 1942
No. 16-16 Bryant Hydraulic, 1942
No. 172 Heald Hydraulic, Gap, 1940
No. 112 Rivett Universal Internal, 1940

GRINDERS, MISCELLANEOUS
Cincinnati Centerless Lapper, 1942.
No. 600 UK Hanchett Face Grinder, 1946.
No. 35 Excello Univ. Thread, 1940.
HRS Barber-Colman, 1942.

GUN BARREL MACHINES
No. ½ B x 50 P & W Reamer, Latest.
No. ½ B x 30 P & W Reamer, Latest.
No. ½ B x 50 P & W Rifler, Latest.

LATHES, ENGINE
36"x296" American Geared Head, M.D.
27"x192" Niles Timesaver, 2 Carr, 1941
27"x132" Monarch Auto. Sizing, 1942.
27"x96" Niles Timesaver, 1940
26"x180" Betts Bridgeford, 1940.
26"x96" Betts Bridgeford, 1940
10"x20" EE Monarch Toolmakers, 1943

LATHES, PRODUCTION
No. 5D Potter & Johnston Automatic, 1943
8"x84" Lo-Swing Semi-automatic, 1941
Lipe Carbo-Matic Lathe, 1942

LATHES, TURRET
No. 1A Warner & Swasey Saddle Type, 1941
No. 1L Gisholt Universal Saddle Type, 1942
No. 3R Gisholt Universal Saddle Type, 1943
No. H5 Libby Universal Saddle Type, 1939
No. 5 Gisholt Universal Ram Type, 1942
No. 6R Denver Universal Ram Type, 1942

MILLS, PRODUCTION
M-18 Milwaukee, 1943
No. 1224 Milwaukee Simplex, 1943
No. 08 Cincinnati Vertical, 1943

MILLS, TOOL ROOM
No. 3 Cincinnati Vertical, M.S. D.T. 1940
No. 3 Van Norman Plain, 1942.
No. 2 MI Cincinnati Plain, 1951
No. 2I Van Norman Plain, 1942

SHAPERS
16" Gornetti Universal Shaper, New.
20" Gornetti Universal Shaper, New.
18" Brook Universal Shaper, New.
24" Gornetti Universal Shaper, New.

PRESSES
650 Ton Verson Dbl. Act. Eccentric, 1940
No. 166 Toledo Toggle Press.

Partial Listing — Write for latest stock list

INDIANAPOLIS Machinery & Supply Co.
1961 S. Meridian St. • • Indianapolis, Indiana

MODERN MACHINES
#9A Jones & Lamson Turret Lathe—new 1941 Serial #65107—Rebuilt and guaranteed
Heald #25A Rotary Surface Grinder—Serial #4577 Reconditioned and guaranteed
3'9" Column Cincinnati Bickford Radial Drill Serial #2A-41—new 1936—Rebuilt & guaranteed
72" King Heavy Duty Vertical Boring and Turning Mill—Serial Lot 38-#175 Rebuilt & guaranteed
4½" Bar Giddings & Lewis #45 Table Type Horizontal Boring, Drill and Milling Machine—Serial #8150. Reconditioned & guaranteed
Ingersoll Adjustable Rail Planer Type Milling Machine—Serial #3158—Reconditioned and guaranteed
#64 Fellows Gear Shaper Ser. #26113
#64A Fellows Gear Shaper—Ser. #25634
Rebuilt 6' 15" Column American Triple Purpose Radial Drill—Serial #55592. Rebuilt & guaranteed
60" Hanchett Face Grinder—Reconditioned and guaranteed
6D Potter & Johnston Automatic Chucking Machine Serial #70393
16" Gould & Eberhardt Shaper—Ser. #66737

HAZARD BROWNELL

MACHINE TOOLS, INC.
350 Waterman St., Providence, R. I.

FELLOWS Gear Shaper
61-A Purchased New in 1943

WINSTON MACHINERY CO., INC.
326 West Ohio St. Indianapolis 2, Ind.

PRESSES
No. 167 Toledo S. C. Toggle Drawing Press Plunger 21", Blankholder 13½", 250 Ton Cap.
No. 3 W.F.F. 4 Post High Speed Blanking Press, 2" Stroke, 200 RPM, M.D. Double Roll Feed, Scrap Cutter.

THE STATE MACHINERY CO. INC.
869 Congress Ave., New Haven, Conn.

SOME LATE MACHINES STILL AVAILABLE

BORING MILLS

Bullard 24" V.T.L., Spiral Drive
Cleveland 2½" Bar Capacity
Giddings & Lewis #32, 3" #25, 2½" Cap.
King 42", 72" Vertical 2 rail heads
Niles-Bement-Pond 4", 4½" Bar, 60" Vert
Niles-Bement-Pond 60" Vertical
New 3" Horizontal Boring Mills

DRILLS AND RADIALS

Brand New Radials
American 6'x15" Universal
Baker No. 321 Vertical Boring & Drill
Bausch Multi-spindle
Buffalo #2 Motor Spindle, #16—4 Sp.
Buffalo: Power No. 41, No. 42
Canedy-Otto 21" Sliding head New
Cincinnati Bickford 6'x15" col.
Natco #12 20 spindle drill
24" Sibley Sliding head
New Geared Box Col. Drills 24'
Foote-Burt #25 3" capacity
Leland Gifford 2 LMS, 3 MS

NEW VERTICAL MILL

ENGRAVERS

Gorton #1A, ME, 1D, 3Z, Deckel GL1, G1, GK2
Preis—UE3—2 dimensional
Taylor-Hobson 3 dimensional Pantograph

GEAR EQUIPMENT

Barber-Colman Mod. SHS. Sharpener
Barber-Colman #2, #12 (3)
Browne & Sharpe Hobber Type S
Browne & Sharpe #3 Gear Mill, 26" Cap.
Fellows High Speed Shapers 712, 725, 71, 7
Fellows #20M Redliner, Flather 72" Cutter
Gleason #2 Surface Hardener, No. 3 Gear Tester
Gleason #3 Spiral, #3 Straight Bevel
Gould & Eberhardt 36" Cutter
Michigan Gear Finisher 24" cap., 862-24A
National Broach Red Ring Lapper, Finisher
Schuchardt & Shutte #1 Hobber

GRINDERS, MISCELLANEOUS

Browne & Sharpe #2 Universal 14"x28"
Brown & Sharpe #5, 3"x18" Cylindrical
Browne & Sharpe #3 Universal w/Internal Sps.
Browne & Sharpe #13 Universal Tool & Cutter
Bryant #5. Internal, chucking 16A16
Bryant, Hydraulic Int. Model 24B—36"x16"
Cincinnati 6x18" Hyd. #4—Centerless
Grenby Models 1G1 & 1G2—Internal
Gorton Ped. Type Tool Grinder
Heald #73 Internal Centerless, Sizematic
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic
Landis 6"x30" Type C Cyl., 10x24 Univ. 12x30
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 10"x18" Type C cylindrical
Norton 14"x96" cyl., 16x48 Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer
Pratt & Whitney Radius Model R6
Rivett Internal with External Sps.
Sellers 6-G Drill Grinder
Sellers 69 Tool, K.O. Lee tool
Van Norman #666 Crankshaft
Wicaco Internal

NEW IN STOCK

Air Hydraulic Presses — Arbor Presses #6C Famco — Band Saws Johnson Kalamazoo — Famco 6x12" — Drill Presses all sizes—Hydraulic Press Northern 20 Ton—Injection Molders, 1 ounce—Power Presses, OBI, 1, 4, 4½, 5, 7½, 10, 15, 20, 30, 55, 85 ton—Shapers, 7", 8", 14", 18" Shaperite—Shears, Foot 22" to 8', 16 & 18 ga.—Shears Power 3'x18 gauge to 10' x 10 ga.—Welders, Arc, Seam, Spot, all sizes Motors Grinders Buffers.

AUTOMATIC SCREW MACHINES

Brown & Sharpe (2) Model 2G, serial No's. 8500 & 11500 series, 1⅛", 1½" capacity.
Brown & Sharpe (9) Model 0G, serial No's. 9600 & 10700 series, ⅝" capacity.
Brown & Sharpe (6) Model 00G, serial No's. 14, 15, 1600 series, ⅝" capacity.
Ceco Screw Machine ⅜" capacity.
Cleveland, Model AA-11, Serial #36586.
Cleveland, Model B, Serial #42618/843, 1-1/16" capacity.
Conomatic 4 Spindle, Serial 2309FF, 1½"
New Britain Gridley 61 6 Spindle, Serial No. 25410, 1⅝" capacity.

GRINDERS, SURFACE

New 8x24" Hyd. Feed, 10x18", 6x18"
Abrasive 8x24", #33 Vert. & #34
Blanchard #16, 26" Mag. Chuck
Browne & Sharpe #5, #2 with Chuck
Heald 22—12" chuck, Arter 12"
Norton 6x18" Hydraulic Vertical
Portman 12" Chuck Rotary
Pratt & Whitney 12x36" Vertical
Thompson Hyd. 8"x24" Hor., Spindle
Taft Pierce #1 Precision

LATHES

American 14"x30", Bridgeford 36"x20', 32"x16'
Gisholt Simplimatic 18"x16½", 2 Tables
Hendey 12"x42" and 12x30", 1941, 16x66"
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed, 13x42", 17"
LeBlond 25/50x96" Gap, Late type.
Lipe-Carbo 12"x18" (2)
Lodge & Shipley #3A, Duomatics
Pratt & Whitney 16"x60—Late
New 16, 18, 20", 28" Immediate Del.
New Tool Makers 10x24", South Bend 9"
Reid Small Piece #9WSL, Sheldon 12"
Rivett Model 918 Precision, Mod. 715
Putnam, Sliding Gap 22"/46"x92"
Sundstrand 8x15", 15' Stub
Wickes 32"x35' Geared Head

MILLS, PLAIN, UNIV. PROD.

Brand New Universal Mills No. 1, No. 2
Archdale Plain, 14" Production
Brown & Sharpe #3B Plain. Late, 3A, 21, #2L
Cinn. No. 3, 4 Plain Spd., 18" Manufacturing
Kent Owens 1V, 1-B, 1-1A, 1M
Kempsmith #1 Pl., Vert. & Div. Hd.
Milwaukee 2H Univ., 2H Plain.
Milwaukee #2B, Plain & Univ.
Sundstrand #00, 0, Rigidmils
Sundstrand #3A Rigidmil with copying Attach, 33
Van Norman #2L Univ. Dividing Head

MILLS, VERTICAL

Brand New Vertical Mills
Cincinnati 2 Spindle Hydromatic
Cincinnati (2)—1-1B Plain Automatic
Cincinnati #3, #4 hi-power, 08 Vertical
Cleveland No. 1, table 8"x32"
Morey #12M Profiler, 2 sp.
Reed Prentice Vert. Mill & Die Sinker

PRESSES

Bliss No. 1 Double Action Drawing Press
Bliss 645, 650 Hi-Production Presses
Bliss 18, 19, 21, OBI, 58, 62, 162, OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton SS, Bliss 74½
Bliss 5-48 Obl. 32x48" bed, Cushion
Hamilton 850 Ton S.S. Bed 27x48
Hamilton 110 FM Die Tryout Press
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Niagara Horning, 15 Ton
Niagara A1¾, O.B.I., Niagara No. 27
Stokes Tablet Press, type R, Late, Model F
Toledo 92½c Double Crank 43x23" bed
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing
Walsh No. 3 O.B.I. 23 Ton, LJ #3
Z & H #4½, O.B.I. 20 Ton

TURRET LATHES

Acme 6W Fox 2-9/16" Cap. #2 Cross Slid. Turret
Bardons & Oliver #2, 3, 5, 7, Bar Feed
Brown & Sharpe, #2 Hand, #10, 11
Denver 6 2" Shell Turret (2)
Foster #2B 2½" Cap. Morey #2G Late
Gisholt 2L, Cross Slid. Tur.
Gisholt #5, Bar Feed, Plenty of Tools
Gisholt 4R—9¼" hole in spindle
Libby 1H5 with threading att.—3R, 4R
Morey #2G Late
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1, #1A, 2, #4

MISCELLANEOUS

Band Saw: New Kalamazoo & Johnson
Bolt & Pipe Threader: Landis Oster-Williams
Borematics: Heald Models 46 & 46B, Late
Boring Bar: Underwood 4"
Broach: New 6 Ton, Horizontal, 11 Ton Vertical
Hacksaw: Peerless 6"x6", Racine 6"x6"
Hand Mill: Whitney
Hoist: 5 ton capacity 7½ HP motor
Honer: Micrematic H-4, MC1H
Jig Borers: New Swift
Keyseater Davis, Baker
Oil Groover: WICACO
Pipe Bender, Kane & Roach, Vari-drive
Planer: Niles-Bement-Pond 36x36'x10'
Rotary Table: Cincinnati, power take-off
Saw. Shaping 6x6", 13x13"
Scrap Cutters & Granulator: Ball & Jewell
Shapers: 24" Rockford, 24", 28" Gould & Eberhardt. Cinn. 20, 24", Columbia 36"
Shears Power, 10' 3/16", 10" x 16 gauge
Vertical Milling Att. New, Bridgefield
Tapper: Haskins—2C, 1A, Bakewell #2
Welder 50 KVA Eisler Air Operated, New Seam.
Welder: Taylor-Winfield 50 KVA Hi-Wave

New Lathes 16" to 28", Mills, Boring Mills, Broaches, Shears & Presses

HYDRAULIC EQUIPMENT

8 and 9 oz. Injection Moulders
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
150 Ton Triple Action HPM Press
200 Ton W.F. Hobbing Press
250 Ton Watson & Stillman 28x24"
300 Ton Watson & Stillman 24x29"
300 Ton Watson Stillman 20"x20" Platen 8" St. 19" opening
600 Ton Williams & White 42"x60"
800 Ton Williams & White 42"x60"
800 Ton W&S Hobbing Press

All Hydraulic Equipment is completely engineered and checked by a competent staff thus assuring reliability.

Send us your Hydraulic problems.

AARON MACHINERY CO., Inc.

This is but a partial listing. Write for free Catalog. Inquiries invited. HUNDREDS OF OTHERS

AARON MACHINERY CO., Inc., 45 Crosby Street, New York 12, N. Y.

"CABLE—AARMACH N. Y." **Telephone WOrth 4-8233**

HEADLINERS

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- No. 3 MILWAUKEE Universal Miller, motor in base, power rapid traverse, double overarm
- No. 4 CINCINNATI High Power Universal Miller, A.C. M.D.
- No. 4-B BROWN & SHARPE Heavy Plain Miller
- No. 81 HEALD Internal "Sizematic-Gagematic"
- No. 2 NORTON Motor Driven Tool & Cutter Grinder
- No. 33 ABRASIVE Vertical Spindle Surface Grinder
- 7" x 7" PEERLESS "Mechani-Cut" Hack Saw
- 38-44" NILES-BEMENT-POND Vertical Turret Lathe, A.C. M.D.
- 36" x 120" centers AMERICAN 12-speed Grd. Hd. Lathe, A.C. M.D., taper attachment
- No. 1-A WARNER & SWASEY Universal Turret Lathe, Timken bearing
- 10' x 10 ga. NIAGARA Power Shear, A.C. M.D.
- 8' x 12 ga. Model A-3-6 STURDYBENDER Press Brake

The above is a partial listing of our stock. We solicit your inquiries.

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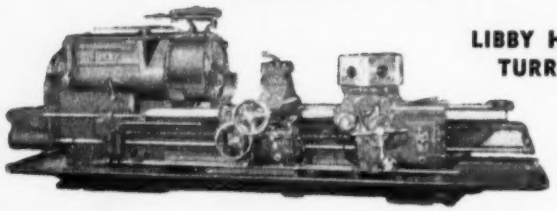

LIBBY HEAVY DUTY TURRET LATHE

MODEL No. 3H-10

SPECIFICATIONS: Swing over ways ins. dia.—29, Spindle hole ins.—10¼, Turret carriage travel 72", Motor hp—25 to 50, Tool post carriage travel—66½", Speed of motor rpm 1500 or 1800, Range of Feeds (Cross or Longitudinal) ins. .007 to .500, Threads per inch 2 to 128, No. of spindles 8, Spindle speeds 8 to 125. Approx. wt. 22,500.

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FLOOR TYPE BORING MILL

with Floor Plate, Outboard Support & Electrics

Motor: 25 HP. 250V DC 400-1200 rpm

"V" Belt Drive

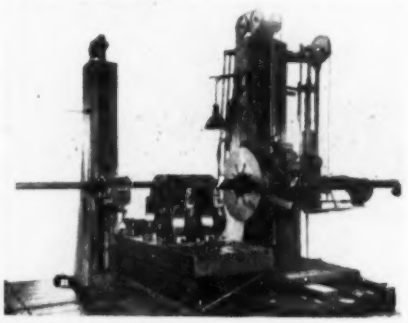
SPECIFICATIONS

6½ Diameter bar with 50" travel

13' High column

12' Travel

14'x14' Floor Plate with "T" slots



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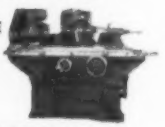
BROWN & SHARPE No. 2 UNIVERSAL GRINDER



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#2 Warner & Swasey Electric Turret Lathe. Late model.

8"x21" Fay Automatic Lathe. Mfd. in 1946.

6 DRE Potter & Johnson Automatic Turret Lathe.

Worthington duplex Air Compressor. 865 CFM, 125 h.p. Very little use.

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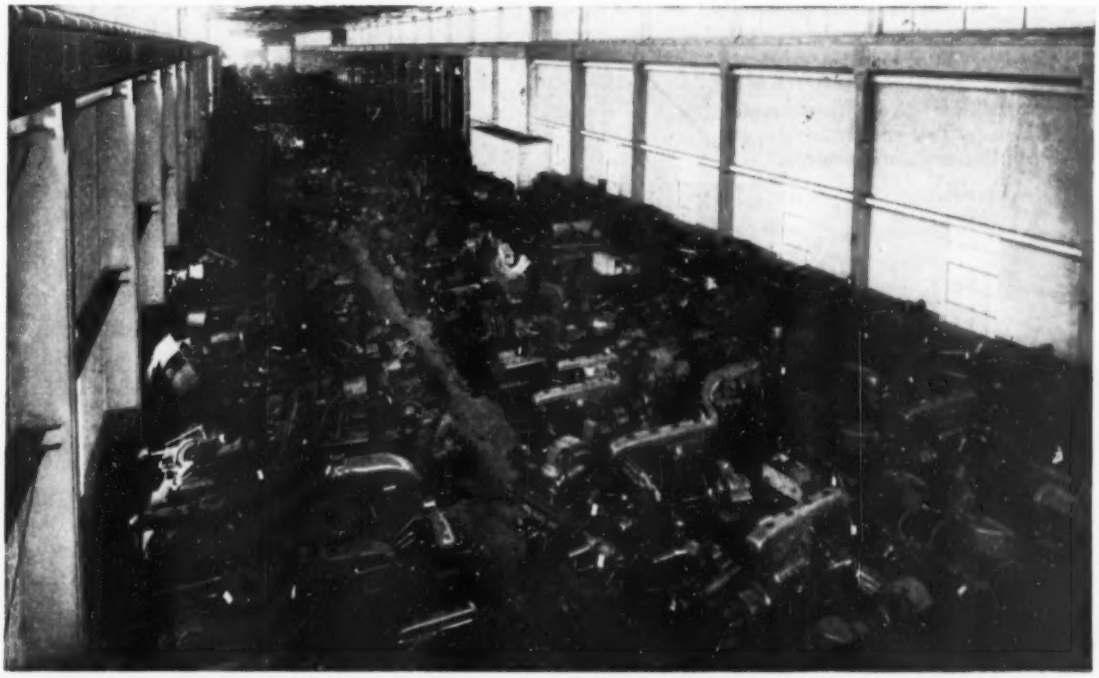

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Niles-Bement-Pond Quartering Machine, m.d., new
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Gustav Wagner Cold Saw, m.d.
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Kolle Heavy Duty Steel & Metal Bandsaw, Model BSM-40, new
6x6" Racine Power Hack Saw, model 2C

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16" Hercules Shaper, m.d., new
22" Hercules Shaper, m.d., new
24" Barner Back Geared Crank Shaper, cone
24" Potter & Johnston, cone
30" Morton Draw-Cut Shaper
32" Cincinnati H.D. Back Geared, cone, motorized
32" Morton Draw-Cut, m.d., late
32" Ohio Dreadnaught Extra Heavy, m.d.
36" Morton Draw-Cut, m.d., late
36" Ohio Dreadnaught Extra Heavy, m.d.

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10" Newton, m.d.
10" Newton, cone
12" Bement-Miles, m.d.
15" Canada, m.d.
18" Dill, m.d.
18" Niles-Bement, s.p.d.
18" Betts Crank Slotter, m.d.
20-24" Dill, m.d.
22" Betts, m.d.
48" Niles, m.d.

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Acme Semi-Automatic Nut Tapper, 6 spindle, 1½", arranged for m.d.
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2 spindle Haskins, pneumatic control
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Baush Radial Drilling & Tapping Machine, m.d., latest

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No. 3⅝" cap. Gray Sheet Metal Cutter, m.d.
8'x⅛" cap. No. 188 Dreis & Krump Leaf Brake, m.d.
No. 336 cap. ⅜" W. J. Savage Co. Nibbler

TURRET LATHES AND SCREW MACHINES

No. 601 Oster Geared Head Rapiduction, m.d. in leg, chucking
No. 1 Warner & Swasey, bar, m.d.
No. 1A Warner & Swasey, m.d.
No. 1, 2 Cincinnati-Acme Full Universal, m.d.
No. 2A Warner & Swasey, m.d., bar
No. 2F Foster Fastermatic, m.d., Timken
No. 3 Cincinnati-Acme Full Universal, m.d., chucking
No. 3 Foster Geared Head, m.d.
No. 3F Foster Fastermatic, m.d., Timken
No. 4 Warner & Swasey, cone, bar and chucking types
No. 4A Warner & Swasey Universal, m.d., chucking
No. 4FU Foster Fastermatic, m.d., latest
No. 5 Foster Universal, m.d., bar, late type
No. 7 Bardons & Oliver, cone
⅝" Pratt & Whitney Hand Screw Machine, cone, bar
2½x24", 3x36", 3½x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking types
18" Libby Type A, m.d., chucking
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20" Dreses, arranged for factory m.d.
26" Libby Type C, m.d., chucking

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No. 37E Wilson Hydraulic, hand operated, 50 tons, new
No. 5 Greenard Arbor Press, floor type, hand operated

AUTOMATICS

4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
No. 5D Potter & Johnston, m.d.
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay Flanders Type, m.d.
4 spindle 2¼" Cleveland Model "K", m.d.
4¼" Model L National Acme Automatic, m.d.
No. 8A Cleveland, m.d., 8" cap., latest

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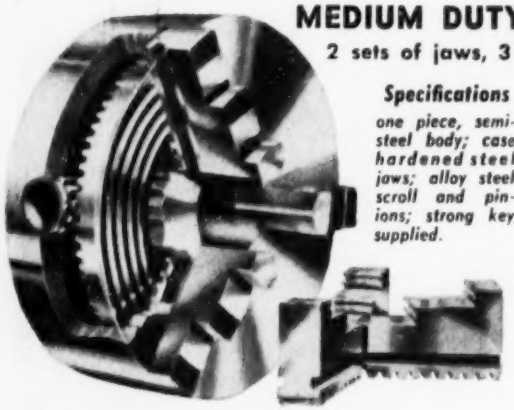

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2 sets of jaws, 3 pinions, for use with intermediate backplate.

Specifications *one piece, semi-steel body; case hardened steel jaws; alloy steel scroll and pinions; strong key supplied.*

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6"	17½	45.00	10.00
7½"	29	57.50	13.50
9"	42	67.50	15.00
10½"	62	95.00	20.00
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18"	200	250.00	35.00
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40"x144" cc Pittsburgh Engine Lathe, L/C
20"x96" cc LeBlond Eng. Lathe, Lima Drive
20"x48" cc LeBlond Eng. Lathe, Lima Drive
#601-WD Oster Hand Screw Machine, MTB
#21 B&S Production Mill, MD
#13-B B&S Production Mill, MD
#2 Kent Owens Hand Mill, MD
#57 Niagara SS Single Crank Press, 71 ton, 3" stroke, 7½ HP Motor
#33 Toledo Styles Type Press, 33 ton, 1½" stroke, 2 HP Motor
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MODEL 2-24
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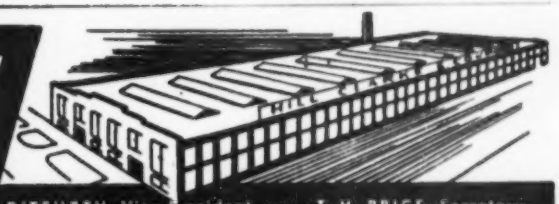

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1-1/16" Model A Cleveland (1942)

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2 Spdl—24/ Sw—No. 3 Avey
D-31 Fox Multiple Dril, No. 2 Taper
6' Western Radial

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No. 12HS Gould & Eberhardt Hobber
11" Gleason Bevel Gear Generator
No. 64 Fellows Gear Shaper
No. 36-BM G & E 3 Spdl, Rougher
No. 612-A Fellows Gear Shaper
No. 615-A Fellows Gear Shaper
No. 65 Fellows—Cone Dr.
8" cap Red Ring Gear Lapper

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16"x33" R-14 Seneca Falls Auto. Lathe
13¾"x39" Centers Dimco Lathe (New)
15"x39" Centers Dimco Lathe (New)
18"x59" Centers Dimco Lathe (New)
23"x60" Centers Dimco Lathe (New)
24"x39" Centers Dimco Lathe (New)
19"x8' LeBlond Hvy. Duty Lathe
36"x18' Putnam Grd. Hd. M.D.
No. 4 Warner & Swasey Tur.-Bar Fd.
5W Acme Ram type Tur., 2" Capacity
No. 6 Warner & Swasey Tur.-Bar Fd.
18" Libby Tur. Lathe, M.D.
No. 3AL Gisholt
No. 3AL Gisholt Cross-Slide Tur.
No. 4A Warner & Swasey—7½" Hcie—Spdl.

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66"x18" Norton Cylindrical (1943)
Hill-Clarke Norton Type Motor Driven Grinders

10"x36" centers	14"x36" centers
10"x50" centers	14"x72" centers
10"x72" centers	20"x96" centers
10"x96" centers	
24"x32" Gap x 144" centers	

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No. 22—12" Heald Rot. Gdr. (1944)
5B Bryant Internal Grd.
No. 16-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 74 Heald Internal Centerless

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54"x30"x16' Ingersoll Slab Mill
4"x9" Hanson-Whitney Thrd.
6"x168" Pratt & Whitney Thrd. Mill
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12"x102" Lees Bradner Thrd. Mill

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36"x36"x12' Cincinnati, 2 hds.
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75 Ton R & K Straight Side Press
3 Ton Fox Hydraulic Press
2—12"x96" Magnetic Chucks
20'x1" cap Southwark Roll
15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
No. 0 Bakewell Tapper

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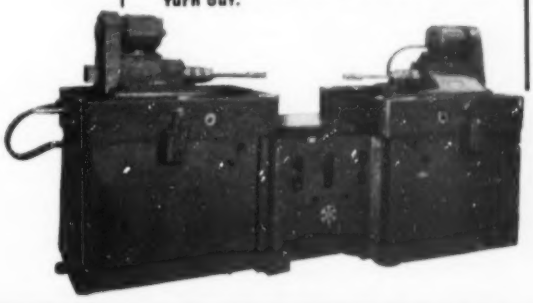
Model 200 H-5 Double End Micromatic Hone. See this machine in our plant, tested under power. Know what dependable work it can turn out.



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1-1/16-1⅜ CLEVELAND Model A Automatic Screw Machine (3)

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3'-7" CINCINNATI Royal Radial Drills New (2)
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25" SIBLEY Stub column 3" capacity

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#3½ BLISS Solid Back Stiles type (1)
#4 WALSH OBI BG
#21 BLISS OBI, (3)
#19 BLISS OBI, (4)
#6B32 VERSON 150T 3½ double action
#95½ TOLEDO 250T
#5 VERSON OB Steel Frame
660 TOLEDO 100T (4)
25 & 50 Ton HENRY & WRIGHT dieing machines
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3L GISHOLT Cross sliding turret
#4 W&S, GH, MD
#2 BROWN & SHARPE Wire Feed (3)
#1 BROWN & SHARPE Wire Feed
#0 BROWN & SHARPE Wire Feed (2)

MISCELLANEOUS

6" JONES Vertical Slotter M.D.—1940
2 to 5 HP Buffers (11)
#0 LAPOINTE Horizontal Broach
XA3 OILGEAR Hydraulic Broach
#V-18 AMERICAN Vertical Broach
NATIONAL Semi Automatic Nut Forming Machine
NIAGARA #180 Combination Machine
BLISS #112 Rotary Trimmer
202½ V & O Trimming Machine

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LATHE—32" x 21' c/c Bridgeford G.H.
MILLER VERT.—28" x 72" and 36" x 118" (New)
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GARDNER HORIZONTAL DISC GRINDER
Model #17B, 72" Segment Type Wheel
Complete with Motor, Electrical Equipment and Wheel Dresser
Excellent Condition
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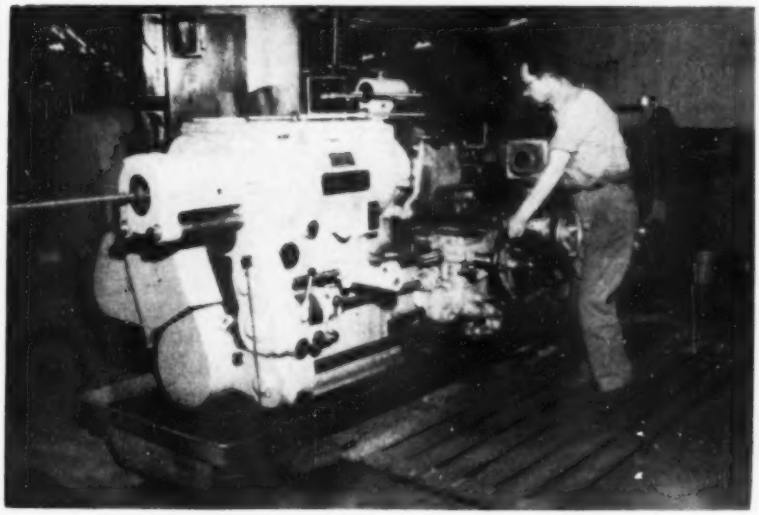

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LATHES

GISHOLT No. 12 Aut.
SUNDSTRAND No. 8 Stub, 1941
MONARCH 14 x 30, 1936
MONARCH 14 x 54, 1937
1—REED PRENTICE 16 x 54, New
AMERICAN 16 x 54, 1945
REED PRENTICE 16 x 96, 1941
MONARCH 18 x 48, 1942, Ser. #16073

PLANERS

SELLERS 10' x 10' x 25'
ROCKFORD 32x36x120 Hyd., Openside

TURRET LATHES

WARNER & SWASEY No. 2, 1939, Ser. #48127
WARNER & SWASEY No. 3
3—GISHOLT No. 3 Univ., BF, 1941-3
GISHOLT No. 5, 1941
LIBBY No. H-5, 1940
WARNER & SWASEY No. 1A Pre., 1942
WARNER & SWASEY No. 2A Pre., 1942
GISHOLT No. 3R, 1942
GISHOLT No. 3L, Tapper Attch., BF, Cross Slide Turrets, 1936
WARNER & SWASEY No. 4A Chucker, Ser. #298000
4—FOSTER Fastermatics, No. 4FU
2—BARDONS & OLIVER No. 2, Elec.

BORING MILLS

HEALD No. 48A Hor., 2 Spdl. Single End
GIDDINGS & LEWIS No. 30, 3" Hor., w/2 Aux., Ser. #4806
BULLARD 24" Vert., 1940, Ser. #16817

MILLS

CINCINNATI No. 08 Vert. Rotary Table
CINCINNATI No. 1-12
SAIMP No. 2 Vert., New
KEARNEY & TRECKER No. 3H, 1943
INGERSOLL Duplex 24"x36", 1942
CINCINNATI No. 4-48 Production
BROWN & SHARPE No. 2 Light Type, 1941
CINCINNATI Plain No. 2MH, 1941

GRINDERS

HEALD Rotary Surf., No. 22, 1942
NORTON 10 x 36", Ang., Ser. #16604
HEALD Mod. 72A-5, Int. Surf., Ser. #15279
BRYANT No. 24-36
LANDIS 6 x 18 Cyl., 1943

GEAR MACHINERY

LEES BRADNER Spline Hobber
8—BARBER COLMAN Type A Hobbers
2—GLEASON No. 12 Rougher & Finisher, Ser. #19787 & #215790
FELLOWS Mod. 7125A Shaper, Ser. #19733
FELLOWS Mod. Z Shaper
GLEASON 12" Spiral Cutter Sharpener, Ser. #10444

SCREW MACHINERY

CONE 1⅞" 8 Spdl., 1942
GREENLEE 2" 6 Spdl., 1940
CLEVELAND Mod. B, 2½", Late
CLEVELAND Mod. A, 3¾", Late
GOSS & DE LEEUW 7½", 6 Spdl. Aut. Chucker, Work Rotating, 1943

DRILLS

ALLEN MS No. 2½, PF, #3MT
CANEDY OTTO 3' 7" Radial, Used
BARNES No. 201¼
BAKER No. 121
BAKER No. 321
BARNES Mod. 242, #5MT
BARNES Mod. H-3, Hydram, 1941
NATCO D-13-H, Multiple Spdl., Hyd.
EDLUND 6 Spdl. HF, #2MT, 2 Tap Spdl.

MISCELLANEOUS

BUFFALO Angle & Bar Shear, 12" I-Beams, 8" x 8" 1¼" Angle, 4" Sq. Cap., 1944
PEERLESS Power Hack Saw, 6" x 6", Ser. AX-141
CHICAGO PNEUMATIC Air Compressor, 300 Cu. Ft
MITTS & MERRILL Keyseater No. 6

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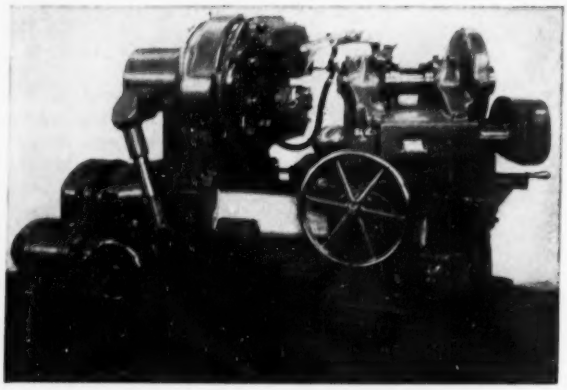

GLEASON 12" Straight Bevel Gear Generator.

BILGRAM 6" Bevel Gear Generator; M.D., late.
BILGRAM 16" Bevel Gear Generator; M.D., late.
GLEASON #6 Revacycle, M.D., late.
GLEASON 10" Spiral Bevel Gear Generator; late.
GLEASON 11" Bevel Gear Generator; late.
GLEASON 12" Spiral Bevel Cutter Sharpener; M.D., late.
GLEASON No. 14 Hypoid Gear Grinder; M.D., late.
GLEASON 18" Straight Bevel Gear Generator.
GLEASON 24" Straight Bevel Gear Planer; M.D., late.
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GLEASON 37" Straight Bevel Gear Planer; M.D.

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20"x10' LODGE & SHIPLEY Selective Geared Head
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42"x15' AMERICAN Heavy Duty Lathe
42"x25' centers AMERICAN Heavy Duty Lathe

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6"x18" NORTON Vertical Spindle Surface Grinder
10"x24" LANDIS Universal Grinder
10"x72" LANDIS Type C Hyd. Pl. Grinder—1942
No. 104 RIVETT Internal Grinder

AUTO LATHES & TURRETS
No. 918S RIVETT Handscrew Machines
No. 2 B&S Wire Feed Hand Screw Machine
No. 2 B&O Geared Elec. Turret Lathe
No. 1L GISHOLT Saddle Type Turret Lathe, 1942
Nos. 4D & 6S P&J Auto. Lathes

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No. 0-8 CINCINATI (Model OT) Vert. Milling Machine
No. 1-8 KENT OWENS M.D. Production Miller
No. 1-14 KENT OWENS M.D. Production Miller
No. 1-18 CINCINNATI Plain Mfg. Miller
Model MM-5 U.S. Multi-Miller
No. 2M CINCINNATI Vertical Miller, 1941
18" CINCINNATI Mfg. Knee Type Milling Machines
No. 36 VAN NORMAN Plain Ram Type Miller
4½x36" P&W Model C Thread Miller
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No. 725A FELLOWS High Speed Gear Shaper
No. 12 FELLOWS Gear Shaver, 1943
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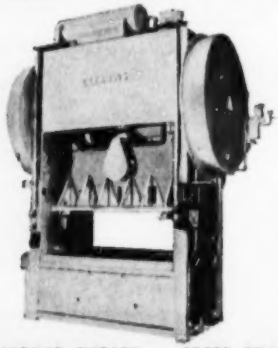

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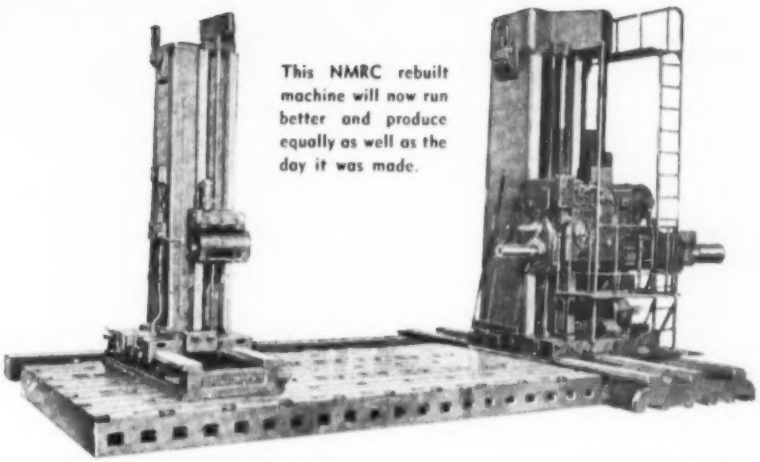

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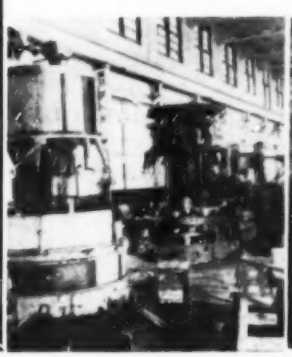

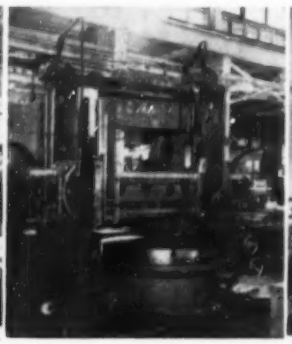

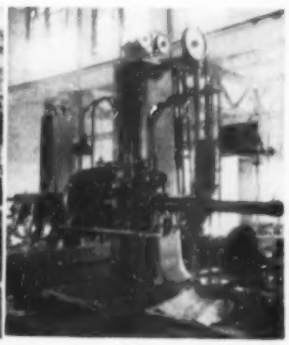

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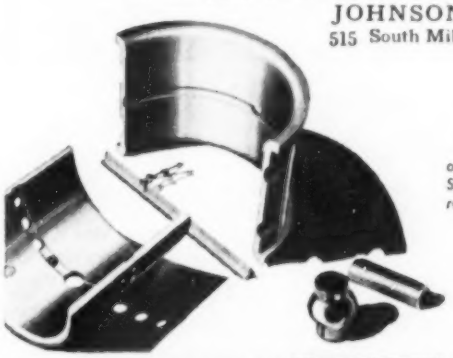

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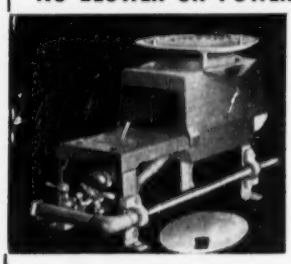

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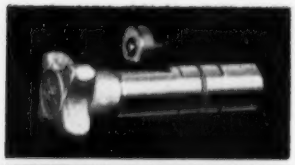

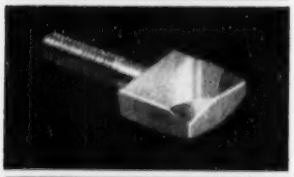

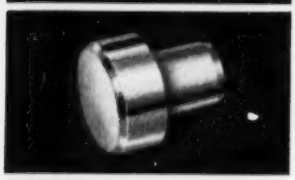

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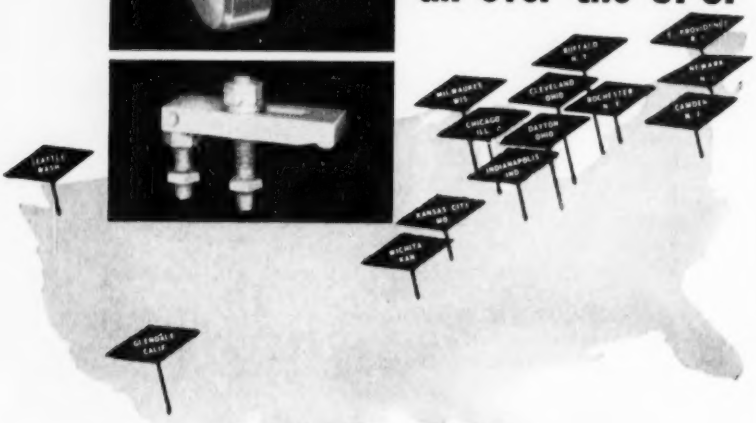

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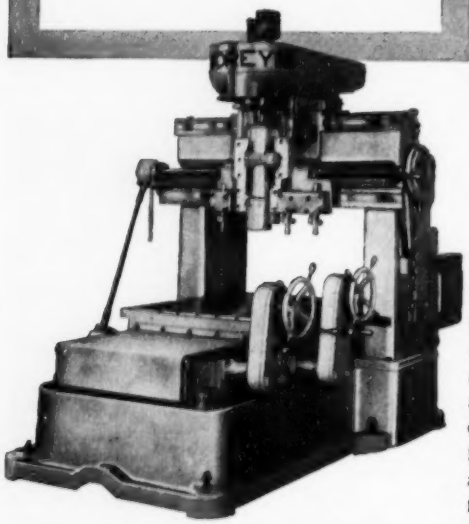

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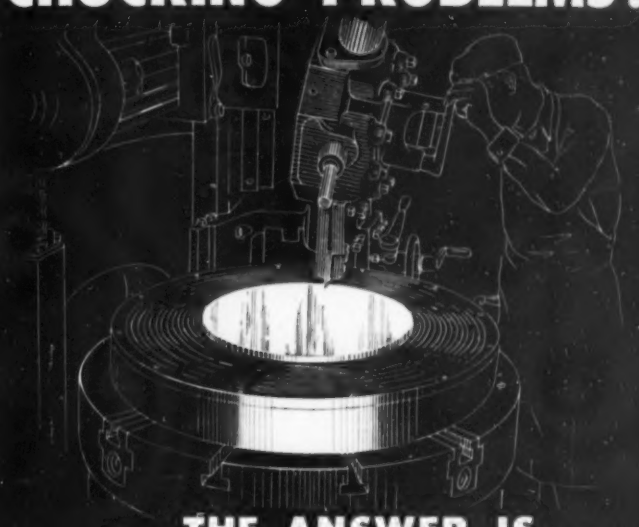

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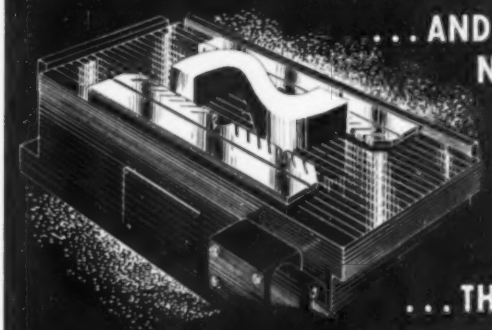
Magna-Lock electro-magnetic CHUCKS

Get details... WRITE DEPT. AM-33

Rectangular . . . rotary . . . swiveling. Wide range of sizes and voltages. 22% more magnetic area . . . pieces held to extreme edges of chuck. Moisture-proof. Exclusive all-steel construction. Many other advantages.



...AND FOR HOLDING NON-MAGNETIC MATERIALS ON MAGNETIC CHUCKS ...THE ANSWER IS

*patented

Magna-Vise*

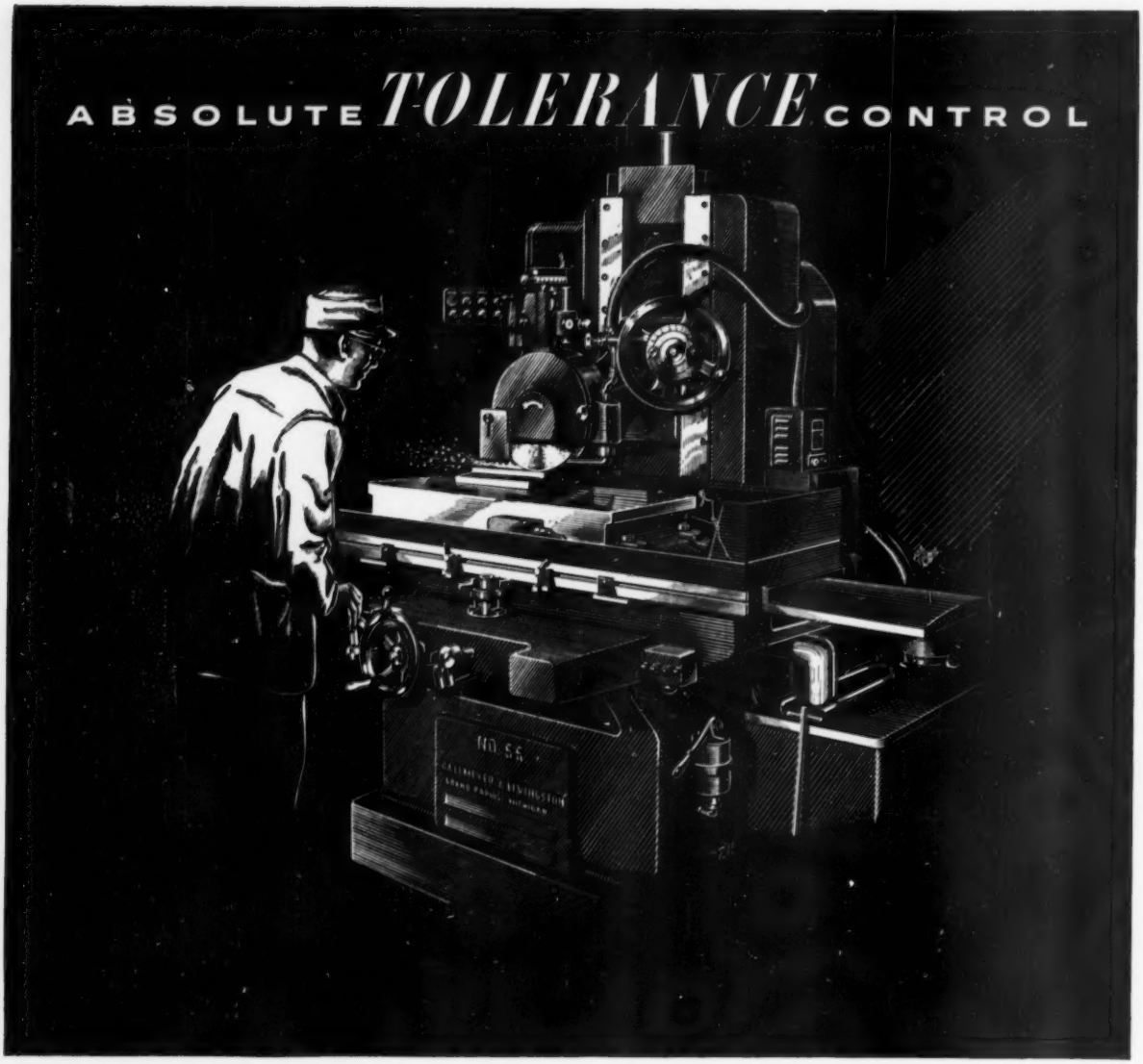
Magna-Lock is first to increase your machine's productivity

Hanchett MAGNA-LOCK CORPORATION

Magnetic Chucks and Devices

BIG RAPIDS, MICHIGAN, U. S. A.

ABSOLUTE *TOLERANCE* CONTROL



When job specifications leave no leeway, when extreme tolerances must be maintained . . . that's when the built-in precision and absolute tolerance control of Grand Rapids Grinders proves most valuable. Defense commitments make it impossible for us to fill your orders as rapidly as we'd like to . . . but we know our customers can appreciate the reasons for delay. As always, we're doing our best to serve you.

GALLMEYER & LIVINGSTON CO.
330 Straight Ave., Grand Rapids, Mich.

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Manufacturers of
SURFACE GRINDERS • CUTTER and TOOL GRINDERS • TAP and DRILL GRINDERS

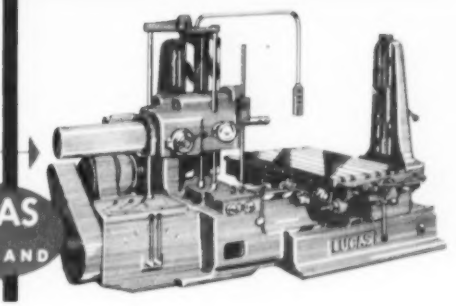
Lucas leads again in Horizontal Boring Machines
with *new* developments in . . .

Automatic Power Positioning

Now you can position units time after time to the same hair-splitting tolerance because of a fixed constant power feed rate.

THE NEW BRITAIN MACHINE COMPANY
LUCAS MACHINE DIVISION, CLEVELAND 8, OHIO

. . . Machines for Making Progress
Lucas Horizontal Boring, Drilling and Milling Machines



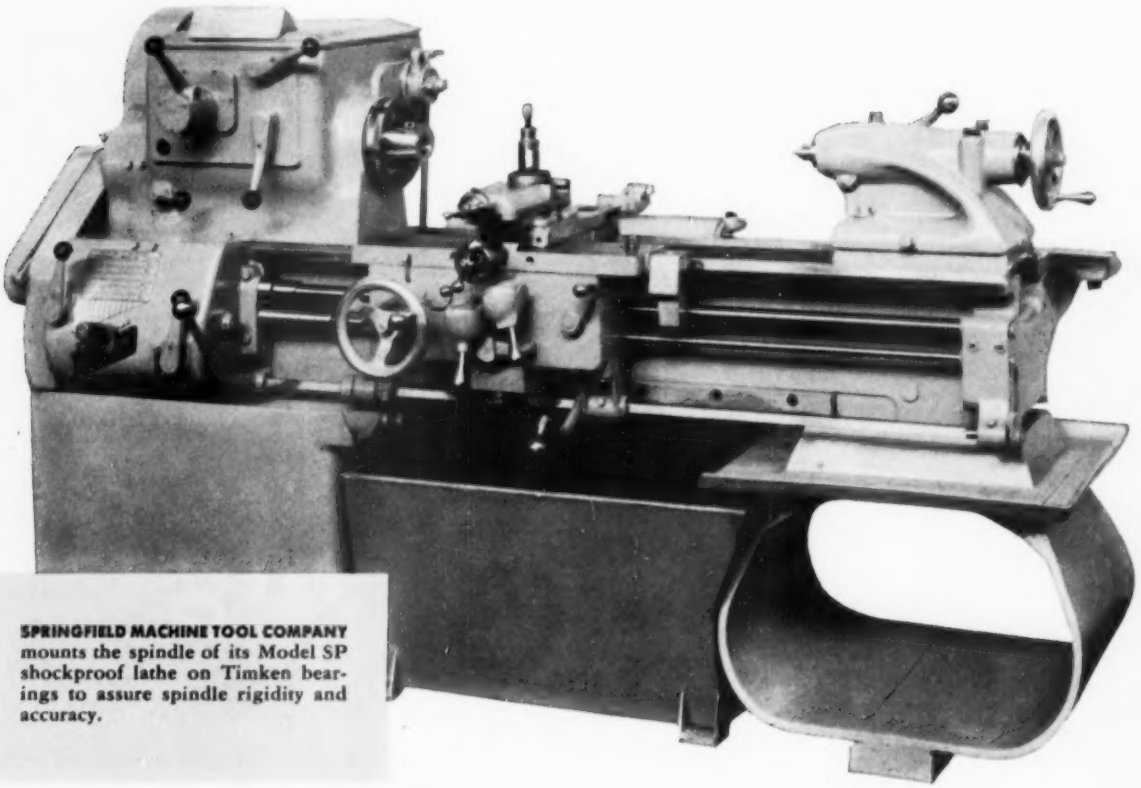
Sea-going lathe has sea legs for steadiness ...TIMKEN® bearings for precision

THIS new Springfield shockproof lathe is especially designed for high precision machine work while bolted to the deck of a naval vessel at sea. It has a radically different structure and special "sea legs" that prevent it from weaving when the deck flexes and enables the machine to withstand the severe shock of near misses and other combat-incurred stresses. Spindle rigidity and accuracy, essential for high precision work on land or sea, is maintained with Timken® precision tapered roller bearings.

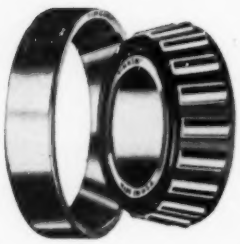
Timken precision bearings are especially designed for spindle applications. Run-out tolerances can be held to a maximum of 75 millionths of an inch. The tapered design of Timken precision bearings enables them to take both radial and thrust loads in any combination, holds spindles rigid and permits pre-loading to any desired degree to prevent chatter. Tapered design also makes Timken precision bearings easy and less costly to assemble (bench assembly is possible), and eliminates the need for special thrust bearings.

For the past 25 years, Timken precision bearings have been an important factor in the development of precision machine tools. Next time you buy or build a machine tool, be sure it's equipped with Timken precision tapered roller bearings. Always look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian Plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



SPRINGFIELD MACHINE TOOL COMPANY mounts the spindle of its Model SP shockproof lathe on Timken bearings to assure spindle rigidity and accuracy.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION ◫